THE

PRACTICAL MECHANIC'S

JOURNAL.

VOLUME V.

APRIL, 1852—MARCH, 1853.

"The INTRODUCTION of NOBLE INVENTIONS seems to hold by far the most excellent place in human actions; and this was the judgment of antiquity, which attributed divine honours to INVENTORS, but conferred only heroical honours upon those who deserved well in civil affairs. And whoever rightly considers it, will find this a judicious custom in former ages, since the benefits of INVENTIONS may extend to all mankind, but civil benefits only to particular countries, or seats of men; and these civil benefits seldom descend to more than a few ages; whereas INVENTIONS are perpetuated through the course of time."—BACON.

"Any accession to our knowledge of nature is sure, sooner or later, to make itself felt in some practical application; and a benefit conferred on SCIENCE, by the casual observation or shrewd remark of even an unscientific or illiterate person, infallibly repays itself with interest, though often in a way that could never have been at first contemplated."—HERSCHEL.

"FORCES, whose silent operation in elementary nature, as well as in the delicate cells of organic tissues, still escapes the cognizance of our senses, will one day become known to us, and, called into the service of man, and awakened by him to a higher degree of activity, will be included in a series of indefinite extent, through the medium of which the subjection of the different domains of nature, and the more vivid understanding of the universe as a whole, are brought continually nearer."—HUMBOLDT.

LONDON: PUBLISHED FOR THE PROPRIETORS BY
GEORGE HEBERT, 88 CHEAPSIDE.
GLASGOW: 166 BUCHANAN STREET.
OFFICES OF THE PRACTICAL MECHANIC'S JOURNAL,
(PATENT OFFICES,)
47 LINCOLN'S INN FIELDS, LONDON, & 166 BUCHANAN ST., GLASGOW.

See preceding page.

INDEX.

LIST OF PLATES,

AND BINDER'S DIRECTIONS.

THE

PRACTICAL MECHANIC'S JOURNAL.

A FEW WORDS ON OURSELVES.

It has become a custom, in the course of a publication extending over many years, occasionally to revert to the intended scheme, as expressed in the first Editorial address; and a very wholesome custom is it, both to the conductor and to the public, for it reminds the former of his duties, and the latter of its rights. On the occasion of putting forth this, the first number of our fifth volume, we adopt, accordingly, the like course; and it is with no misgivings that we turn to our numerous pages, and take account of the matter which, four years ago, we ventured to promise to our readers.

The prophecy which we uttered with regard to the benefit of our then intended labours has been more than fulfilled, and the kind letters from all parts of the globe, and unsolicited notices from friendly reviewers, with which we have been favoured, enable us to state now, as a thing of the past—that which existed only in our prospective views. We can say—and we say it with feelings of some pride—that to the Manufacturer we have afforded information as to the improvements which have been continually introduced into the arts and manufactures at home and abroad, and a knowledge of which is absolutely necessary, in order to keep pace with the requirements of the times, and to compete successfully with rival producers. We have assisted the Workman and Student with explanations on questions of principle and detail: yielding parallel applications of the one, and new illustrations of the other, putting our readers on a level with the discoveries of the age; and the Inventor has had the means of making the fruits of his labour known to the public, and of reaping a due reward; while the list of our annual subscribers shows that our Journal is not uninteresting to the general Public, who, in it, possess a means of better estimating the real merits of the speculator and adventurer, and of passing right judgment upon those things which would otherwise take their patronage by storm.

We have brought before our readers the most useful discoveries in Mechanics, Engineering, and the Practical Sciences, and illustrated the details with carefully-prepared explanatory drawings; and we are proceeding with a series of practical papers, explaining, in an intelligible manner, the minutiæ of various Arts. In our pages are to be found, articles embodying general views and outlines of the different branches of scientific knowledge, and being perspicuous expositions of their respective subjects; and in their turn, everything connected with natural science, directly or remotely bearing upon mechanical labours, has received attention. The leading facts of science, so essential to the young and true mechanic, needing, and therefore desiring *in*-formation, have, likewise, as space afforded, been communicated in the way of compendium; and, as a considerable aid to this, we have diligently watched and reported the proceedings of the great leading Scientific Societies, who form the preachers of that secondary faith which results in demonstrative knowledge beneficial to all mankind.

The Reviews which we have furnished of books and other publications, but particularly of patented and registered productions, have, we may conscientiously affirm, been dictated by strict impartiality, and with reference to their real merits only.

We certainly did not originally contemplate that our resources in the graphic and engraving department, would have been drawn upon to such an extent as our latter volumes show; and the labours of our staff of excellent draughtsmen and engravers in metal and wood have been appreciated.

Upon this matter we may be allowed to advert to the numerous large plates which, with others, we have given of the most important machines in the Great Exhibition. Among these are already to be found Adams' Locomotive, Carrett's Steam Pump, Gwynne's Centrifugal Pumps, Fairbairn's Tank Locomotive, Hawthorn's Locomotive, Dick's Antifriction Power, Joyce's Pendulous Engines, Macindoe's Mule, Milligan's Loom, Rémond's Envelope Machine, Schiele's Millwork and Curves, White & Grant's Safety Apparatus for Mines, Randell & Saunders' Brick and Tile Machine, Robinsons & Russell's Sugar Mill, and Siemens' Electric Telegraph, whilst many other examples, from the same source, are already engraved, and will shortly appear in these pages.

In the past four volumes of the *Practical Mechanic's Journal* will be found 92 large engravings on copper, and upwards of 1200 engravings on wood, in the production of which alone we have incurred an outlay exceeding £2000.

Since our Journal has been established, many others have started, and we have bade all welcome with a hearty good-will. We could not do otherwise if we would; for there is a moral chain in which these things bind us, and from which we would not willingly be released. We owe it, however, to ourselves to state, that in some publications our articles, with the illustrative woodcuts, have been repeatedly copied without the least acknowledgment of their having first been introduced to the world through our columns. We think we have a right to mention this in a tone verging upon complaint, more particularly in some instances, although we can but rejoice that the observations originating with us have thus been the means possibly of extending the information we would furnish.

In our first address, when alluding to the means of production which our home-machinery affords, we remarked, "There are rivals in the market, and abroad a very formidable one—the local producer." And we now repeat what we then said, that "it is the inevitable tendency of all successful enterprise to engender

rivalry, and then there is a keen struggle to *make* cheaper with a view to *sell* cheaper."

This rivalry and this tendency have been brought more than agreeably home to us by the results of the Great Exhibition. Our vanity has been checked. The fortress which we thought impregnable has been found to have *many* weak points, and the honourable enemy have entered through breaches which we never thought to exist. Without intending any pleasantry, it is obvious that this state of things, which the distinguished lectures on the results of that great trial of skill are enforcing upon our attention, must put the English mechanical world more upon its *metal*. We have much to learn, much to unlearn, and much to do. Our mechanics and our inventors must, like the common schoolmaster, be abroad; and associating, as we do, with the publication of such a Journal, the profession of Patent Agents in London, Edinburgh, and Glasgow, facilities are afforded to us which, although not by any fault, are denied to others. This has enabled us, in many instances, with that peculiar power attaching to the public press, to insist upon the meritorious claims of mechanical invention and ingenuity being heard, which otherwise might have shared the usual fate of private endeavours, however energetic. This is almost a natural result. For inventors, like men of the deepest science, in numerous instances, find such gratification in their work and its accomplishment, that they look to that alone rather than to the reflection, so to speak, of any pecuniary benefit to themselves. The tale is no uncommon one of such individuals even dying of dearth, with all those waters near which they themselves have spread, or contributed to spread, upon the world around.

But we are tired of talking so much of ourselves. One word for others. To our kind anonymous contributors, and to our correspondents—and especially to our foreign correspondents—all thanks are due, and are here tendered. Many of their articles have contributed to enlighten our pages, and most of their suggestions have, as they know, been cheerfully adopted. A very complete alphabetical Index to the four volumes of the *Practical Mechanic's Journal* is now published, and may be had *gratis* on application at any of our three Patent Offices, or at our publisher's. With one word more we *must* conclude. The demand for back numbers and volumes, with which we have been more and more favoured, induces a confidence that the benefit of our labours is of a permanent character. Hence, even the very low price of our publication is not expended for the mere gratification of the moment, and that is a matter becoming, as literature increases, of more importance; for the English mechanic is, from his ordinarily confined means, of all men most solicitous to have a shilling's worth for his shilling. Our Past shall speak for our Future.

OUTLINES OF GEOLOGY.

I.

INTRODUCTION.

The aim of the geologist is to read the history of the earth from observation of its present structure. Geology can hardly be said to have existed more than sixty years. Before that time, theories of the original condition of the earth, and of its subsequent changes, were many; but facts were few, and frequently misunderstood. These theories generally originated with mathematicians, who endeavoured to apply the method which had proved successful in their own science, to inquiries of a different kind. As in geometry, they started from certain data (which in this case, however, were not axioms, but hypotheses), and endeavoured to deduce from them the condition of the earth as they knew it actually to be. Their efforts, however, were attended with little success; perhaps the exertions of an English surveyor, William Smith, who explored the whole of England on foot, and subsequently (in 1815) published a geological map of the country, advanced geology more than the previous three centuries of *à priori* reasoning. It is now clear that geology could not be advanced by starting from fanciful hypotheses. On the contrary, in this instance the beginning must be made at the end; we must first ascertain the actual condition of the earth, and when we have done so, we may be able (by proceeding backwards) to infer what were its earlier states of existence, so that geologists must at present proceed *inductively*. Their business is to collect facts, and to draw immediate inferences from these facts. Inductions will thus accumulate, and these will prove, or assist in proving, more general truths, so that at length it is possible that inductions of such generality may be so established, as to enable geologists to proceed in part, at least, *deductively;* in which case, in geology as in astronomy, the highest truths may be deducible from a few simple laws. That time, however, is apparently far distant; at present, geology is in its infancy, and depends for its advancement on the accumulation of facts, and skilful inductions from these facts.

To a person making a survey of some limited portion of the earth's surface—let us suppose Great Britain—it would at once be apparent that the land was composed, below the surface, of rocks of different external appearances and compositions; that, in some places, compact rocks rise up in masses as mountain chains; in others, different rocks lie upon each other in beds, which are either horizontal, or with more or less inclination. A series of rocks of the latter kind might first be noted in some part of the island, and subsequently one apparently the same, or very similar in appearance, would be discovered in another part; and in this latter, the same order of superposition would be observed, so that the two series would be shown to form parts of the same bed. Exact resemblance in external appearance would not often be discovered, and, when discovered, the investigator would soon find that external resemblance is not an infallible guide to the age of rocks. He would therefore look for some evidence more to be depended on, and this is afforded by organic remains. When the two kinds of evidence are (as not unfrequently happens in comparing rocks in different parts of the earth) at variance, no doubt exists as to which is most trustworthy. Most of the rocks which come under the geologist's notice, contain traces of organic forms, either vegetable or animal, the latter bearing in most cases a resemblance to existing marine animals. These remains are not scattered promiscuously throughout a long series of beds. A given form has a limited range, being only found in one bed, or in a small series of neighbouring beds; and this general rule may be stated, that the older the bed, the more different are the fossil forms from existing forms. Moreover, whenever a species, present in the lower beds of a series, ceases to appear in the middle beds, neither will it be found in the higher beds of that series; it will have ceased altogether. Reasoning on these facts, the geologist concludes, that the rocks which contain remains of creatures resembling existing marine animals, were deposited by the sea, and that the age of any bed in a series, with reference to the rest, is to be determined by its relative position, being older than those above, and newer than those below it. Moreover, if a bed of rock in a given locality is found to contain organic remains resembling those discovered in a bed situate in another locality, he will conclude that the two beds are of the same age, so that the date of the latter bed with reference to neighbouring beds being known, the date of the former with reference to adjacent beds is known also. Again, a bed may be found, whose organic contents agree in part with those of one bed of a known series, and in part with those of a neighbouring bed, in which case it will be classed, either as chronologically between the two, or as contemporaneous with both. Rocks will sometimes occur, of which a few only of the organic remains agree with those of any known bed. In these cases, and others of greater difficulty which often occur, it will be necessary to appeal to every kind of evidence, part of which will belong to the peculiarities of the individual case, and cannot be generally described. On these principles, the rocks of that large part of Great Britain, which consists of the *sedimentary* beds, are arranged in groups distinguished by peculiarities in the organic life preserved within them. Each group or *system* (as it is called) consists of numerous beds, which may differ widely from each other in most particulars, but which agree more or less in their organic contents. To belong to a given system, implies only the being of a certain age, and the age is chiefly determined by the foreign bodies embedded in the deposit, and the order of superposition. Even if it were possible to group rocks into three great classes by means of their mineral characters alone, we should still have to depend upon something different for breaking down these classes into orders; but it is very doubtful whether even the first could be done. Having thus classed the deposits which have come under his notice into systems, the geologist will perceive, on comparing different systems together, that they naturally fall into three great divisions, distinguished from each other by differences even more marked than those which separate the different systems from each other, and he is therefore led to separate the whole series into primary (or palæozoic), secondary, and tertiary classes. We have remarked that the different *systems*, such as the carboniferous, the cretaceous, the

silurian, consist of numerous deposits, differing from each other in mineralogical character, though *on the whole* agreeing in organic remains. These differences give rise to the subdivisions of systems into *formations*, consisting of a fewer number of beds, having certain peculiarities in common, either mineralogical, or sometimes in the organic remains embedded in them. Such subdivisions are chiefly useful for local reference. Thus we have sedimentary rocks classed, first, as primary, secondary, and tertiary; next, subdivided into *systems*, which again are locally distributed into *formations*. There are, however, other rocks easily distinguished from those just mentioned, by containing neither trace of stratification nor fossil remains, and by appearing generally in massive forms, as elevated chains, or table lands, sometimes seeming to have been pushed through the sedimentary rocks which lie on their flanks.

It would have taken the geologist long to have read the history of this new class of rocks, if he had not been assisted by the products of modern volcanoes, which in some cases are very similar to them. Hutton, who originated the idea of the igneous origin of granite, discovered in Glen Tilt (about 1785) unequivocal confirmation of his views, for the granite there (as in numerous other places since discovered) penetrates the adjoining rocks in veins, and this could only have been brought about when it was in a fluid state. Between the rocks of igneous origin, and the earliest beds which contain organic remains, are found, in England and elsewhere, certain beds resembling the former, in not containing organic remains, and the latter in being stratified. Such are the rocks known as gneiss and mica schist. By some writers these rocks are called metamorphic, with reference to a doctrine originating with Hutton, but owing its celebrity to Sir C. Lyell, according to which these rocks had a sedimentary origin, and probably contained organic remains. Having been subsequently acted upon by heat under pressure, their texture was altered, and they lost all traces of their organic contents. Other geologists suppose that the rocks were deposited by water, which, for unknown reasons, never contained organic forms. The question thus raised as to the origin of these rocks is of peculiar interest, inasmuch as it involves the validity of the evidence hitherto adduced to support the hypothesis of the existence of inorganic matter, previous to the existence of organic life.

The investigations of geologists abroad have only tended to establish the facts of British geologists, and their inferences, as we have now stated them. Several hypotheses and systems, indeed, have been formed at variance with them, but they were afterwards abandoned. Thus, Werner, in Germany, classified rocks according to their mineralogical character, and assumed that difference of mineral character always indicated difference of age, and that similarity of mineral character indicated the same age.

Geologists appear to have generally assented to a threefold division of all rocks, into platonic (which includes all kinds of granitic rock), metamorphic, and fossiliferous; and the further division of the fossiliferous into palæozoic (or primary), secondary, and tertiary, grounded on their organic remains, is universally followed, at least in England.

It is stated by Sir C. Lyell (Prin. of Geology, 1847), that not more than one-tenth of the dry land of the globe has been surveyed by geologists; but the general geological features of a much larger part are known.

The rocks at the surface of the present dry land of the globe have been classed by M. Boné as follows; but (as Mr. Johnston remarks), in the general filling up of the map of the world, constructed in accordance with this classification, a good deal is merely conjectural.

1. The crystalline schistose, comprehending granitoid rocks, and also the metamorphic rocks of Lyell.
2. Primary, stratified; transition or silurian strata, including the carboniferous series.
3. Secondary; extending from the close of the carboniferous, to the close of the cretaceous series.
4. Tertiary.
5. Alluvium, or modern detritus.
6. Volcanic; being igneous rocks of the tertiary and alluvial epochs, and some extra European porphyries and diorites.

We shall not follow this arrangement strictly, except in noticing geographical distribution.

ELLIS'S BLOOMING ROLLS.

Mr. Thomas Ellis, of the Tredegar Iron Works, Monmouthshire, is the inventor of a simple modification of the common machine for rolling blooms or piles of iron, which possesses some very important advantages over the old arrangement. The system on which it operates is, that the rolls are made to rotate first in one direction and then in the other, so as to roll the pile backwards and forwards in the direction of its length—thus forming both ends of the bloom alike.

Fig. 1. Fig. 2.

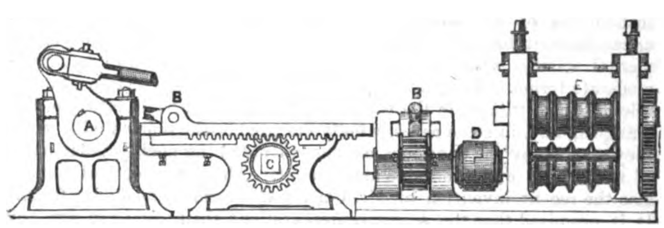


Fig. 1 is an end view of the rolls and actuating crank, the connecting-rod of which is represented as broken away. Fig. 2 is a view at right angles to fig. 1, showing the rack and pinion apparatus as divested of the driving crank. The rolls are actuated by the main shaft, A, constantly revolving, and carrying on its end a powerful crank, to the pin of which is jointed a connecting-rod, passing to an eye, B, on one end of a horizontal toothed rack. This rack slides in guides on the top of a pedestal, forming the bearing of a short shaft, having upon it a toothed pinion, C, with which the rack gears. This shaft is coupled at D with the lower of the pair of rolls, E; so that as the shaft, A, revolves, it gives a continuous reciprocatory rotatory motion to the pinion, C, and through it to the rolls.

The result of this system of rolling is, that the bar of iron is made of uniform quality throughout its entire length, whilst the bloom does not require to be lifted over the top of the rolls, as is the case at present. Hence arises a considerable saving in time and labour—for two men and two boys are able to roll by it five tons per hour, or sixty tons per day of twelve hours, and blooms of from 10 cwt. to a ton can be managed with comparative ease.

The machine has now been rolling for some time at the Tredegar works, and has passed through it upwards of 13,000 tons without accident.

THE ROYAL PANOPTICON OF SCIENCE AND ART.

Multiformity of benefit to the individual, and multiplicity of benefit to man in general, may, without speaking with severe refinement, be considered the most readily appreciable symbol of progress. As the patriotism of him who merely makes two blades of grass to grow where one only grew before is not to be despised, so the people who furnish forth separate centres from which the rays of art and science may extend, may be said to be moving in the right way. It is the multiplicity of such institutions, in whatever form they may be, that make a nation great; for they appeal to the highest exercise of the highest faculties. They form no broth and gruel diet, but substantial stuff, upon which the great body of the people may be kept in a healthy, and therefore, necessarily, a still more continuing progressive state. For such reason, whenever we see anything of the kind, or hear of it as only intended, we are always ready to welcome the new comer with heart and hand. These observations have been elicited by the metropolitan institution, which is proposed to be called by the above name.

Situated on the recently large vacant space on the east side of Leicester Square, is now erecting a building of colossal dimensions, the architectural design of which will represent the only type in London of the Eastern mosque-like style. Two minarets, one hundred feet in height, rising at each end of a not unpleasing façade, will lend proportion and grandeur to a noble dome of glass, some twenty or thirty feet higher. This dome, and the vast hall, nearly a hundred feet in diameter, which it will enclose, surrounded by three extensive galleries, will form the main feature of the edifice. The institution is incorporated by royal charter, dated the 21st of February, and is designed for scientific exhibitions, and for the promotion of discoveries in arts and manufactures. The scheme is due to the enterprising energies of Mr. Edward Marmaduke Clarke, who is more particularly known to the scientific world by his invention of the hydro-oxygen dissolving views, &c. It is proposed that from the minarets, at night, there shall be exhibited lights of sufficient power to illuminate the whole area of the square; while in the interior will be arranged such stores as the progressive improvements in physical science, and industrial and fine art, and the resources of the present age, are capable of furnishing. A new feature is intended to be added, by the increasing interests of literature finding an appropriate position. Lectures on all the subjects will be delivered twice a-day, duly illustrated; the morning exhibition being more especially

devoted to scientific information, and that of the evening to artistic entertainment, blended with instruction, scientific, literary, and musical. The council of direction, comprising the names of many men of considerable attainments, associated with business habits, so important to institutions of the kind, also intend to form a large collection of apparatus suitable to lectures in every branch of natural and experimental science, which apparatus will be lent out on hire upon very moderate terms. This, it is hoped, will greatly aid mechanic and other scientific institutions in the three kingdoms, which have, hitherto, been cramped, and, in some cases, wholly defeated in the objects with which they started, by the enormous expense in obtaining such popular means of instruction and profitable amusement. The patent optical diorama, also the recent invention of Mr. Clarke, will form an exclusive feature. It is promised that the scenic representations shall exceed in size anything yet exhibited, divested of those chromatic imperfections which are inherent in dissolving views, as hitherto seen, and which detract materially from their excellence. There is scarcely any movement in nature, which may not be represented by this process; and we are informed that a series of illustrations, in the highest style of art, are in course of preparation. Running observations, by distinguished men, on the dioramic scenes, are intended to effect a mode of dispensing useful knowledge, which has not been, as we feel assured, so successfully prosecuted as it might be, even with the aids at present developed. The musical department is to take high standing, and an organ from the factory of Messrs. W. Hill & Co. is now in course of construction, which, if report speaks truly, is to rival the magnificent instrument at Birmingham. A chemical laboratory is to form another item in the arrangements, and is intended to insure the foundation of a sound school of chemistry in this central position. There will also be a separate department for *teaching* mechanical engineering—an important desideratum, which we regard with peculiar interest. Shaping machines of all descriptions will here find a place, forming an engineer's complete plant of tools, coupled with a select library of scientific books and drawings.

We understand the institution will commence its course of multifarious utility before the end of the ensuing summer; and we can only say, we heartily wish it all the success so comprehensive and enterprising a scheme is entitled to.

On first thought, it is almost natural to imagine that the institution, to which we have now directed attention, is calculated to supplant its elder brother, the Polytechnic. But there is every reason to believe that such will not be the case. Each will undoubtedly possess individual and peculiar advantages, and each will lend a helping hand to the other. The metropolis has long been large enough for both, and more if it could get them. And we know that, with the opportunity of increasing our store of useful information, the desire to obtain it increases in a more than double ratio. The great matter is, to induce habits of scientific and artistic taste in the masses, who, in such matters, are always more fortunate gleaners when the harvest is abundant. The multiplication of such institutions is the only means of bringing home to men's business and bosoms, those facts and generalizations upon which all human opinion and practice may be best founded; and upon every individual learning the lesson aright which they teach, both the particular and the general happiness have the better suretyship of progressive increase.

CALCINATION OF THE ORE BY WASTE GASES AT THE COLTNESS FURNACES.

(Illustrated by Plates 93 and 94.)

The Coltness furnaces in Lanarkshire, as recently arranged, present an excellent example of the economic application of the escape gases, which, in most cases, have hitherto been allowed to flow off unheeded from the furnace mouths. We have already referred to Mr. Houldsworth's patent,* under which the improvements now before us have been carried into practical effect by Mr. Hunter, the energetic manager of the Coltness works; but since the date of those remarks, the scheme has been fully worked out and systematized, so as to enable us to state what has really been accomplished in the regular smelting operations of the works.

In addition to the economy secured by causing the gases to heat the blast, and to produce the steam required by the blowing engine, which keeps the six immense furnaces of the works in constant operation, Mr. Houldsworth makes the furnaces calcine their own ironstone and lime. The precise arrangements of the works are detailed in our plates. Plate 93 exhibits an elevation and section of one of the series of furnaces, with the conducting pipes or channels for the escape gases, and a calcining or roasting kiln. Plate 94 represents, in fig. 1, a front elevation of the four calcining kilns and their chimney—one kiln, and a portion of the details of another, being in vertical section. Fig. 2 is a plan of the blast furnace and calcining kilns, portions of each being delineated in horizontal section.

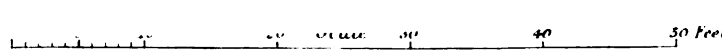
The blast furnace, A, is unaltered, in its general details, from the original Coltness form, B, being the mouth for the introduction of the ore and fuel, and C the blast pipes. Near the top, an annular flue or channel, D, is formed in the thickness of the sides, and this annular channel has a ring of rectangular or other shaped apertures, E, forming the communication between it and the interior of the furnace. On the opposite sides of the furnace, two openings are made in the wall, on the outside of the annular flue or channel, D, for the insertion of the two elbow branches, E′, opening into the two pipes or flues, F. The opposite ends of these pipes terminate or open into the main pipe or flue, G, which communicates, by branch pipes, H, placed upon it at convenient distances, with the calcining or roasting ovens, I. Each kiln has two inlet pipes for the gas, as at *a*, *a*, in the first kiln of the series, shown in horizontal section. Each branch, H, in place of passing directly into the kiln, opens into a small detached furnace or fireplace, J, placed there for the purpose of igniting the gases previous to their entering the kiln, by the pipes, K, opening from the upper part of the ignition furnace into the annular flue or channel, L, formed in the thickness of the wall, near the base of the kiln.

When the blast furnace is in operation, a portion of the escaping gaseous products of the smelting process, flow from the upper part of the furnace, through the outlet apertures, E, into the annular flue, D, as indicated by the arrows. Thence the gaseous current passes along the conveying flues, F, the quantity so passed being adjustable by the oscillating disc-valves, M, rods from which hang downwards, within reach of the furnace-attendant beneath, who, when necessary, can entirely shut off the connection between all of the kilns and the blast furnace. The flow of gas from the main, G, is similarly adjustable by the valves, N, at the entrance of the branches, H, the opposite ends of which branches are expanded, so as to admit the gaseous current above or below the grate-bars, or fire-line, O, of the ignition furnaces. For the regulation of the current at this point, a single-bladed valve, P, is fitted to the expanded branch. When this valve is turned downwards, as delineated in the plates, the gases pass above it, and are directed entirely above the fire-bars; but the current may be divided above and below the bars, or passed entirely under them, by a suitable alteration of the position of the valve. An air-valve is fitted to the ignition furnace, for the purpose of mingling air with the passing gases in sufficient quantity to effect complete combustion. By another modification, the ignition furnace may be placed within the calcining kiln, or it may be constructed so as to form a part of the kiln itself. Instead of this plan of ignition furnaces, the gases may be ignited after entering the calcining kilns, by admitting air to the interior of the kilns, in immediate contact with the ironstone to be roasted. The gaseous current, or flame, passes along from the pipes, K, into the annular flue, L, of the kilns. This flue communicates with the interior of the kiln, by a series of inlet apertures, Q, set at regular intervals all round the base of the kiln. Through these apertures the gases and flame pass in, and effect the calcination or roasting of the ore built up on the floor of the kiln. In order to effect the better distribution of the gases, or flame, in their action upon the ore, a third passage or branch flue, R, forms a communication between the interior of the annular flue, L, and a second smaller flue, or circular chamber, S, formed in the centre of the base of the kiln. In addition to the rush of the gases and flame, or heated products, through the side apertures, Q, of the flue, L, a considerable current passes along the flue, R, into the central chamber, S, whence it is diffused by a ring of openings from the chamber through the base of the kiln, into the centre of the mass of ore. The requisite draught for the calcining kilns is obtained by a chimney, T, which acts for the whole series of four kilns. The ascending gases, flame, and unconsumed vapour, passing up through the body of the kiln, pass off from the top of the latter by the outlet, U, opening into the under side of the long connecting flue, V, built along the range of kilns, and communicating by the short flue, W, with the chimney.

The process of calcination, or roasting, is continued until the desired effect is produced upon the ore under treatment, which can be ascertained in the ordinary manner, when the gaseous current is cut off from the kiln, which is allowed to cool down, to permit of the removal of the calcined ore. The ore to be calcined is charged, or supplied to the range of the kilns, by the top-charging doors, X, a line of rails being laid along and over the kilns, for the passage of the charging waggons. The calcined material is removed from the kilns by the doors, Y, in the front.

Mr. Houldsworth has also provided, in his original plan, for the cal-

* Page 278, Vol. III., P. M. Journal.


10 20 Scale 30 40 50 Feet

cination of the limestone flux, but this branch of his improvements has not yet been adopted.

Figs. 3, 4, 5, and 6, on plate 94, represent the patentee's modifications of the tuyeres or blow-pipes of furnaces. Fig. 3 is a longitudinal section of what he terms his annular tuyere; and fig. 4 is an end elevation of the tuyere mouth. A, is the nose-pipe, entering into the tuyere mouthpiece, B, fitted with cooling water-pipes in the ordinary way. At the tuyere mouth is cast, or attached, a transverse division piece, C, so as to divide the orifice into two parts, D, the object being to divide the effluent current of air into two currents. As these currents issue from the mouth, the inclined surfaces, E, of the tuyere deflect the currents, or incline them towards each other; so that, after quitting the tuyere, the two currents impinge one against the other, and result in a broad fan-light sheet, and the blast is thus better distributed over the materials on which it is intended to act. In this modification the sides of the division piece, C, are merely rounded off; but it is obvious that such sides or surfaces may be beveled off, if necessary, to produce a better impinging of the currents.

Fig. 5 is a longitudinal section of another arrangement of tuyere, and fig. 6 is a corresponding end view of the orifice. In this plan the end of the nose-pipe, A, is rounded or beveled inwards, as at B, and a flat button or disc, C, is attached in the centre of the end of the pipe, so as to leave an annular opening, as at B, for the blast, such annular opening being only interfered with by the narrow ribs or holders, D, of the disc, C. The current or currents are thus deflected, and made to impinge on each other for the purpose already described.

This system of deflecting or spreading the air-blast over an extended surface, may obviously be carried out under various modifications. Instead of deflecting the air by a modification of the form of the tuyere itself, a separate deflecting surface may be attached near, or combined with, the ordinary tuyere, to receive the current, and deflect it upon the materials in the furnace.

At present the operations with the gas at Coltness are confined to three of the six furnaces in blast—two for the blowing engine, which fire four of the boilers, and one for the calcination in one kiln, six more being in progress. This number of kilns, it is calculated, will calcine all the clay ironstone used in the six furnaces.

The weekly produce of each of the three furnaces whence the gas is taken, has averaged about 161 tons. The proportion of No. I. iron is $\frac{5}{8}$ths of the quantity produced, being a larger amount than is usually made in furnaces from which the gas is not withdrawn; thus setting at rest the popular idea, that the withdrawal of the gas reduces the proportion of No. I.

The coal and lime required per ton of iron is not increased, this important fact having been carefully ascertained after a trial of several months. It is also a fact that ironstone, calcined by the gases in close kilns, is easier reduced in the furnace, and in reality requiring a less quantity of coal, whilst the proportion of No. I. is increased. The economy of this mode of calcining clay-band ironstone, in coal, dross, and wages, is at least 2s. 6d. per ton of pig iron—an important consideration, which must have its weight in these days of depressed iron markets.

THE MARIONETTES.

We really must plead guilty to some appearance of negligence, in not having before noticed these new metropolitan theatricals. Our correspondents, calling our attention to them, must, however, have seen that our pages have been fully occupied with matter more immediately connected with our principal objects; and we confess that, until a few evenings ago, we had not felt much inclined to pop in upon the "poppets," which are at present receiving more than a common share of popular approbation. Many of our contemporaries of the press have noticed their performances, and having now witnessed them ourselves, we proceed to tell our readers something about them.

Singular enough, the Puppet Show possesses a copious literature. Puppet, or as Chaucer has it, "Popet," is derived from the Latin *pupa*, a doll. Poppet is even now a term of endearment, often used in the home circle, and which has doubtless descended from the old love of these playthings in times long past.

The French first took advantage of them as a means of exhibiting the burlesque: and the theatre of the Ambigu Comique in Paris, still retaining its name, was, it is stated, originally appropriated to the performances of these dolls, although children were afterwards for a time substituted. In France, puppets have, from an early period, afforded increasing entertainment to the masses, and the *Pantins* and *Coletins* (little figures made of coloured pasteboard and worked with strings) soon became the amusement of the nursery, and passed, for the same purpose, from the continent into England—originating the toy-shop clowns and harlequins of the present day. According to an amusing paper in "Household Words," for the last day in January, it is (strangely enough) from the effigies of the Madonna, or Virgin, that the term Marionettes is derived. According to Ducange, the monkish Latin word for the puppet representative of the Virgin was "Mariola," which has been fused, with "Madonna," into Marionette.

Actors of the kind have almost an universal continental reputation, where these satires and symbols of humanity, whether represented in the gambols of *Polichinello*, or the *Fantoccini*, or the *Ombres Chinoises*, like our own vernacular *Punch and Judy*, have delighted all for ages. Trifling as these things comparatively may seem, it must, nevertheless, be confessed, that the kind of thing which affected so potently, as he eloquently describes it in his autobiography, the great young mind of such a man as Goëthe, is not to be despised.

Some twenty-five years ago, at the old Argyll Rooms, which were burnt down, a theatre of the like description was opened, and amused the town for a season. But nothing can exceed the manner in which these puppets have now been re-introduced to the public. The large room of the Adelaide Gallery, in the Lowther Arcade, has been converted into an elegant little theatre. Some good scene painters have evidently been engaged upon these important accessories, and the dresses of the little ladies and gentlemen are unexceptionable in appropriateness, whether to the superb or the plain. The public owes the production to the taste and liberality of Mr. T. B. Simpson, known so long as mine host of the Albion, and the director of the metropolitan Cremorne. He has brought together about 150 actors, between two and three feet in height, constructed of wood, cork, or papier-maché. But our readers must know that our Marionettes are not a set of mere wooden blocks. Many and many a fashionable or scientific soiree would they shame out and out. They dance gracefully, run, laugh, gape, wink,—do, in fact, everything except the common operation of walking, their efforts at which are ridiculously amusing. Indeed, the humour and drollery of the performances of these little manufactured men and women consist, in part, of their inherent imperfections in correct motion. But in dancing, the *entrechats*, or cross capers, the *aplomb*, the *pirouettes*, and general *abandon*, are almost perfect. With the most proper decorum, they suit the action to the word (spoken for them from behind the scenes), and the word to the action, and gesticulate, in many instances, with far greater grace than some of their originals. The means of communicating these motions to them from above are a little too visible, and the occasional difficulty in bringing them down firmly to the stage floor will probably be got over in time. If the advantage of a *petite* full-banded orchestra could be obtained, it would also greatly add to the effect, the present orchestra being much too noisy. One of our contemporaries says these Marionettes will become remarkable for what human beings *can't* do, for already do we find the General, in "Bombastes Furioso," expressing his passion as much by the movement of his pig-tail as that of his hands. This has a funny effect, but the effort of jumping up perpendicularly, and bodily, as he sings, is still more funnily impressive. It is impossible not to be greatly diverted with these little freaks, which are not destined to amuse a parcel of boys and girls only. Quoting the merry language of the *Sun*, we may say, "There is ample amusement for 'children of a larger growth;' indeed, whoever can find no food for mirth in this revival of a favourite entertainment in the days of good Queen Anne, is only fit to mope in deserts and in caves, and to consort with owls."

There are some who imagine that the puppets, being beyond the licensing chamberlain's reach, may be turned to account in the representation of acting caricature-dramas, relating more to temporary politics, than is permitted on the ordinary stage; and that, consequently, the creation of this new class of literature may be anticipated. A contemporary says that some of our best writers are at work already, for the employment of our little friends. The whole thing is, like everything else in these "young" days, in its infancy. There is no telling what it *may* achieve. It is not our intention to pry too cunningly into the modes by which the effects are at present produced. It does not require much acumen to trace the means employed to produce the effects. We would rather stimulate the originator of this new entertainment to combine mechanical principles and results with the handling of the mere puppet. We can see many effects really not undeserving consideration, which such combination might produce. Making the figures partly automatic, although it would unquestionably increase expense, would render their performances far more interesting, and far more extensively useful. It is not for what they are, but what they thus promise, that has induced us to give them so large a space in our columns; and we strongly recommend all who can do so, particularly our young and ingenious mechanical friends, to pay them a visit, when, gray and grave as we may be, we should delight to be with them.

devoted to scientific information, and that of the evening to artistic entertainment, blended with instruction, scientific, literary, and musical. The council of direction, comprising the names of many men of considerable attainments, associated with business habits, so important to institutions of the kind, also intend to form a large collection of apparatus suitable to lectures in every branch of natural and experimental science, which apparatus will be lent out on hire upon very moderate terms. This, it is hoped, will greatly aid mechanic and other scientific institutions in the three kingdoms, which have, hitherto, been cramped, and, in some cases, wholly defeated in the objects with which they started, by the enormous expense in obtaining such popular means of instruction and profitable amusement. The patent optical diorama, also the recent invention of Mr. Clarke, will form an exclusive feature. It is promised that the scenic representations shall exceed in size anything yet exhibited, divested of those chromatic imperfections which are inherent in dissolving views, as hitherto seen, and which detract materially from their excellence. There is scarcely any movement in nature, which may not be represented by this process; and we are informed that a series of illustrations, in the highest style of art, are in course of preparation. Running observations, by distinguished men, on the dioramic scenes, are intended to effect a mode of dispensing useful knowledge, which has not been, as we feel assured, so successfully prosecuted as it might be, even with the aids at present developed. The musical department is to take high standing, and an organ from the factory of Messrs. W. Hill & Co. is now in course of construction, which, if report speaks truly, is to rival the magnificent instrument at Birmingham. A chemical laboratory is to form another item in the arrangements, and is intended to insure the foundation of a sound school of chemistry in this central position. There will also be a separate department for *teaching* mechanical engineering—an important desideratum, which we regard with peculiar interest. Shaping machines of all descriptions will here find a place, forming an engineer's complete plant of tools, coupled with a select library of scientific books and drawings.

We understand the institution will commence its course of multifarious utility before the end of the ensuing summer; and we can only say, we heartily wish it all the success so comprehensive and enterprising a scheme is entitled to.

On first thought, it is almost natural to imagine that the institution, to which we have now directed attention, is calculated to supplant its elder brother, the Polytechnic. But there is every reason to believe that such will not be the case. Each will undoubtedly possess individual and peculiar advantages, and each will lend a helping hand to the other. The metropolis has long been large enough for both, and more if it could get them. And we know that, with the opportunity of increasing our store of useful information, the desire to obtain it increases in a more than double ratio. The great matter is, to induce habits of scientific and artistic taste in the masses, who, in such matters, are always more fortunate gleaners when the harvest is abundant. The multiplication of such institutions is the only means of bringing home to men's business and bosoms, those facts and generalizations upon which all human opinion and practice may be best founded; and upon every individual learning the lesson aright which they teach, both the particular and the general happiness have the better suretyship of progressive increase.

CALCINATION OF THE ORE BY WASTE GASES AT THE COLTNESS FURNACES.

(Illustrated by Plates 93 and 94.)

The Coltness furnaces in Lanarkshire, as recently arranged, present an excellent example of the economic application of the escape gases, which, in most cases, have hitherto been allowed to flow off unheeded from the furnace mouths. We have already referred to Mr. Houldsworth's patent,* under which the improvements now before us have been carried into practical effect by Mr. Hunter, the energetic manager of the Coltness works; but since the date of those remarks, the scheme has been fully worked out and systematized, so as to enable us to state what has really been accomplished in the regular smelting operations of the works.

In addition to the economy secured by causing the gases to heat the blast, and to produce the steam required by the blowing engine, which keeps the six immense furnaces of the works in constant operation, Mr. Houldsworth makes the furnaces calcine their own ironstone and lime. The precise arrangements of the works are detailed in our plates. Plate 93 exhibits an elevation and section of one of the series of furnaces, with the conducting pipes or channels for the escape gases, and a calcining or roasting kiln. Plate 94 represents, in fig. 1, a front elevation of the four calcining kilns and their chimney—one kiln, and a portion of the details of another, being in vertical section. Fig. 2 is a plan of the blast furnace and calcining kilns, portions of each being delineated in horizontal section.

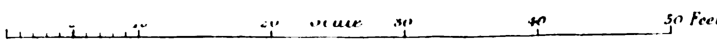
The blast furnace, A, is unaltered, in its general details, from the original Coltness form, B, being the mouth for the introduction of the ore and fuel, and C the blast pipes. Near the top, an annular flue or channel, D, is formed in the thickness of the sides, and this annular channel has a ring of rectangular or other shaped apertures, E, forming the communication between it and the interior of the furnace. On the opposite sides of the furnace, two openings are made in the wall, on the outside of the annular flue or channel, D, for the insertion of the two elbow branches, E′, opening into the two pipes or flues, F. The opposite ends of these pipes terminate or open into the main pipe or flue, G, which communicates, by branch pipes, H, placed upon it at convenient distances, with the calcining or roasting ovens, I. Each kiln has two inlet pipes for the gas, as at *a*, *a*, in the first kiln of the series, shown in horizontal section. Each branch, H, in place of passing directly into the kiln, opens into a small detached furnace or fireplace, J, placed there for the purpose of igniting the gases previous to their entering the kiln, by the pipes, K, opening from the upper part of the ignition furnace into the annular flue or channel, L, formed in the thickness of the wall, near the base of the kiln.

When the blast furnace is in operation, a portion of the escaping gaseous products of the smelting process, flow from the upper part of the furnace, through the outlet apertures, E, into the annular flue, D, as indicated by the arrows. Thence the gaseous current passes along the conveying flues, F, the quantity so passed being adjustable by the oscillating disc-valves, M, rods from which hang downwards, within reach of the furnace-attendant beneath, who, when necessary, can entirely shut off the connection between all of the kilns and the blast furnace. The flow of gas from the main, G, is similarly adjustable by the valves, N, at the entrance of the branches, H, the opposite ends of which branches are expanded, so as to admit the gaseous current above or below the grate-bars, or fire-line, O, of the ignition furnaces. For the regulation of the current at this point, a single-bladed valve, P, is fitted to the expanded branch. When this valve is turned downwards, as delineated in the plates, the gases pass above it, and are directed entirely above the fire-bars; but the current may be divided above and below the bars, or passed entirely under them, by a suitable alteration of the position of the valve. An air-valve is fitted to the ignition furnace, for the purpose of mingling air with the passing gases in sufficient quantity to effect complete combustion. By another modification, the ignition furnace may be placed within the calcining kiln, or it may be constructed so as to form a part of the kiln itself. Instead of this plan of ignition furnaces, the gases may be ignited after entering the calcining kilns, by admitting air to the interior of the kilns, in immediate contact with the ironstone to be roasted. The gaseous current, or flame, passes along from the pipes, K, into the annular flue, L, of the kilns. This flue communicates with the interior of the kiln, by a series of inlet apertures, Q, set at regular intervals all round the base of the kiln. Through these apertures the gases and flame pass in, and effect the calcination or roasting of the ore built up on the floor of the kiln. In order to effect the better distribution of the gases, or flame, in their action upon the ore, a third passage or branch flue, R, forms a communication between the interior of the annular flue, L, and a second smaller flue, or circular chamber, S, formed in the centre of the base of the kiln. In addition to the rush of the gases and flame, or heated products, through the side apertures, Q, of the flue, L, a considerable current passes along the flue, R, into the central chamber, S, whence it is diffused by a ring of openings from the chamber through the base of the kiln, into the centre of the mass of ore. The requisite draught for the calcining kilns is obtained by a chimney, T, which acts for the whole series of four kilns. The ascending gases, flame, and unconsumed vapour, passing up through the body of the kiln, pass off from the top of the latter by the outlet, U, opening into the under side of the long connecting flue, V, built along the range of kilns, and communicating by the short flue, W, with the chimney.

The process of calcination, or roasting, is continued until the desired effect is produced upon the ore under treatment, which can be ascertained in the ordinary manner, when the gaseous current is cut off from the kiln, which is allowed to cool down, to permit of the removal of the calcined ore. The ore to be calcined is charged, or supplied to the range of the kilns, by the top-charging doors, X, a line of rails being laid along and over the kilns, for the passage of the charging waggons. The calcined material is removed from the kilns by the doors, Y, in the front.

Mr. Houldsworth has also provided, in his original plan, for the cal-

* Page 278, Vol. III., P. M. Journal.


30
40
50 Feet

cination of the limestone flux, but this branch of his improvements has not yet been adopted.

Figs. 3, 4, 5, and 6, on plate 94, represent the patentee's modifications of the tuyeres or blow-pipes of furnaces. Fig. 3 is a longitudinal section of what he terms his annular tuyere; and fig. 4 is an end elevation of the tuyere mouth. A, is the nose-pipe, entering into the tuyere mouthpiece, B, fitted with cooling water-pipes in the ordinary way. At the tuyere mouth is cast, or attached, a transverse division piece, C, so as to divide the orifice into two parts, D, the object being to divide the effluent current of air into two currents. As these currents issue from the mouth, the inclined surfaces, E, of the tuyere deflect the currents, or incline them towards each other; so that, after quitting the tuyere, the two currents impinge one against the other, and result in a broad fan-light sheet, and the blast is thus better distributed over the materials on which it is intended to act. In this modification the sides of the division piece, C, are merely rounded off; but it is obvious that such sides or surfaces may be beveled off, if necessary, to produce a better impinging of the currents.

Fig. 5 is a longitudinal section of another arrangement of tuyere, and fig. 6 is a corresponding end view of the orifice. In this plan the end of the nose-pipe, A, is rounded or beveled inwards, as at B, and a flat button or disc, C, is attached in the centre of the end of the pipe, so as to leave an annular opening, as at B, for the blast, such annular opening being only interfered with by the narrow ribs or holders, D, of the disc, C. The current or currents are thus deflected, and made to impinge on each other for the purpose already described.

This system of deflecting or spreading the air-blast over an extended surface, may obviously be carried out under various modifications. Instead of deflecting the air by a modification of the form of the tuyere itself, a separate deflecting surface may be attached near, or combined with, the ordinary tuyere, to receive the current, and deflect it upon the materials in the furnace.

At present the operations with the gas at Coltness are confined to three of the six furnaces in blast—two for the blowing engine, which fire four of the boilers, and one for the calcination in one kiln, six more being in progress. This number of kilns, it is calculated, will calcine all the clay ironstone used in the six furnaces.

The weekly produce of each of the three furnaces whence the gas is taken, has averaged about 161 tons. The proportion of No. I. iron is $\frac{4}{5}$ths of the quantity produced, being a larger amount than is usually made in furnaces from which the gas is not withdrawn; thus setting at rest the popular idea, that the withdrawal of the gas reduces the proportion of No. I.

The coal and lime required per ton of iron is not increased, this important fact having been carefully ascertained after a trial of several months. It is also a fact that ironstone, calcined by the gases in close kilns, is easier reduced in the furnace, and in reality requiring a less quantity of coal, whilst the proportion of No. I. is increased. The economy of this mode of calcining clay-band ironstone, in coal, dross, and wages, is at least 2s. 6d. per ton of pig iron—an important consideration, which must have its weight in these days of depressed iron markets.

THE MARIONETTES.

We really must plead guilty to some appearance of negligence, in not having before noticed these new metropolitan theatricals. Our correspondents, calling our attention to them, must, however, have seen that our pages have been fully occupied with matter more immediately connected with our principal objects; and we confess that, until a few evenings ago, we had not felt much inclined to pop in upon the "poppets," which are at present receiving more than a common share of popular approbation. Many of our contemporaries of the press have noticed their performances, and having now witnessed them ourselves, we proceed to tell our readers something about them.

Singular enough, the Puppet Show possesses a copious literature. Puppet, or as Chaucer has it, "Popet," is derived from the Latin *pupa*, a doll. Poppet is even now a term of endearment, often used in the home circle, and which has doubtless descended from the old love of these playthings in times long past.

The French first took advantage of them as a means of exhibiting the burlesque: and the theatre of the Ambigu Comique in Paris, still retaining its name, was, it is stated, originally appropriated to the performances of these dolls, although children were afterwards for a time substituted. In France, puppets have, from an early period, afforded increasing entertainment to the masses, and the *Pantins* and *Coletins* (little figures made of coloured pasteboard and worked with strings) soon became the amusement of the nursery, and passed, for the same purpose, from the continent into England—originating the toy-shop clowns and harlequins of the present day. According to an amusing paper in "Household Words," for the last day in January, it is (strangely enough) from the effigies of the Madonna, or Virgin, that the term Marionettes is derived. According to Ducange, the monkish Latin word for the puppet representative of the Virgin was "Mariola," which has been fused, with "Madonna," into Marionette.

Actors of the kind have almost an universal continental reputation, where these satires and symbols of humanity, whether represented in the gambols of *Polichinello*, or the *Fantoccini*, or the *Ombres Chinoises*, like our own vernacular *Punch and Judy*, have delighted all for ages. Trifling as these things comparatively may seem, it must, nevertheless, be confessed, that the kind of thing which affected so potently, as he eloquently describes it in his autobiography, the great young mind of such a man as Goëthe, is not to be despised.

Some twenty-five years ago, at the old Argyll Rooms, which were burnt down, a theatre of the like description was opened, and amused the town for a season. But nothing can exceed the manner in which these puppets have now been re-introduced to the public. The large room of the Adelaide Gallery, in the Lowther Arcade, has been converted into an elegant little theatre. Some good scene painters have evidently been engaged upon these important accessories, and the dresses of the little ladies and gentlemen are unexceptionable in appropriateness, whether to the superb or the plain. The public owes the production to the taste and liberality of Mr. T. B. Simpson, known so long as mine host of the Albion, and the director of the metropolitan Cremorne. He has brought together about 150 actors, between two and three feet in height, constructed of wood, cork, or papier-maché. But our readers must know that our Marionettes are not a set of mere wooden blocks. Many and many a fashionable or scientific soiree would they shame out and out. They dance gracefully, run, laugh, gape, wink,—do, in fact, everything except the common operation of walking, their efforts at which are ridiculously amusing. Indeed, the humour and drollery of the performances of these little manufactured men and women consist, in part, of their inherent imperfections in correct motion. But in dancing, the *entrechats*, or cross capers, the *aplomb*, the *pirouettes*, and general *abandon*, are almost perfect. With the most proper decorum, they suit the action to the word (spoken for them from behind the scenes), and the word to the action, and gesticulate, in many instances, with far greater grace than some of their originals. The means of communicating these motions to them from above are a little too visible, and the occasional difficulty in bringing them down firmly to the stage floor will probably be got over in time. If the advantage of a *petite* full-banded orchestra could be obtained, it would also greatly add to the effect, the present orchestra being much too noisy. One of our contemporaries says these Marionettes will become remarkable for what human beings *can't* do, for already do we find the General, in "Bombastes Furioso," expressing his passion as much by the movement of his pig-tail as that of his hands. This has a funny effect, but the effort of jumping up perpendicularly, and bodily, as he sings, is still more funnily impressive. It is impossible not to be greatly diverted with these little freaks, which are not destined to amuse a parcel of boys and girls only. Quoting the merry language of the *Sun*, we may say, "There is ample amusement for 'children of a larger growth;' indeed, whoever can find no food for mirth in this revival of a favourite entertainment in the days of good Queen Anne, is only fit to mope in deserts and in caves, and to consort with owls."

There are some who imagine that the puppets, being beyond the licensing chamberlain's reach, may be turned to account in the representation of acting caricature-dramas, relating more to temporary politics, than is permitted on the ordinary stage; and that, consequently, the creation of this new class of literature may be anticipated. A contemporary says that some of our best writers are at work already, for the employment of our little friends. The whole thing is, like everything else in these "young" days, in its infancy. There is no telling what it *may* achieve. It is not our intention to pry too cunningly into the modes by which the effects are at present produced. It does not require much acumen to trace the means employed to produce the effects. We would rather stimulate the originator of this new entertainment to combine mechanical principles and results with the handling of the mere puppet. We can see many effects really not undeserving consideration, which such combination might produce. Making the figures partly automatic, although it would unquestionably increase expense, would render their performances far more interesting, and far more extensively useful. It is not for what they are, but what they thus promise, that has induced us to give them so large a space in our columns; and we strongly recommend all who can do so, particularly our young and ingenious mechanical friends, to pay them a visit, when, gray and grave as we may be, we should delight to be with them.

TREVITHICK'S COAL-WHIPPING ENGINE.

The discharging of the cargoes of colliers, technically known as "coal-whipping," is perhaps the most severe of the many laborious manual operations which a trip along the Thames can present; and yet, remarkably enough, men have been enslaved in such employment time out of mind, as if so simple a species of work could not be performed—and far better performed—by inanimate mechanism. Besides, human labour so applied is ineffective and costly. It is a hard day's work, under the existing system, to discharge 100 tons, whilst, with Mr. Trevithick's simple engine, 460 tons have been discharged from a vessel in twenty working hours. But, without other argument in support of our case, the importance of the mechanical system of whipping is sufficiently well enforced by the fact of the great reduction of the tonnage rate at which the work can be performed, and the increased despatch afforded to the vessels by the quick rate of discharge. The first of these items is, of course, a very obvious matter of pounds, shillings, and pence, on which Messrs. E. & A. Prior, of Upper Thames Street, who have adopted the new system, have declared themselves well satisfied; but as regards shipowners and masters, on whom the loss of a day or a tide sometimes entails the loss of a voyage, the point of despatch is, perhaps, of still more importance.

Messrs. Prior's engine, of which we furnish three views in our plate 95, has been constructed after the designs of Mr. F. H. Trevithick, the son of the celebrated engineer whose name is so intimately linked with the early history of the steam-engine, and now the assistant locomotive engineer of the Eastern Counties Railway. Fig. 1 is a complete side elevation of the engine, boiler, and machinery complete; fig. 2 is a corresponding vertical section; and fig. 3 is a front view, at right angles to figs. 1 and 2.

Unlike the steam and hydrostatic hoists of the Liverpool, Glasgow, Newcastle, and Dover harbours, where the entire machinery stands on the pier, Mr. Trevithick's apparatus is portable, and is arranged to stand on the deck of the ship, the cargo of which it is discharging. It is placed as near to the "comings" of the hatchway as possible, so that the pull at its periodical lifts may be almost vertical, and thus, small and light as the whole machine is, it has been found to stand steadily without being secured in any way. The actuating engine is of the simplest construction, its steam cylinder, A, being only 6 inches diameter, with a stroke of 16 inches. The forked connecting-rod, B, passes directly upwards to the overhead crank, C, fast on one end of the horizontal winding-shaft, D, carried on a pair of short brackets, E, surmounting the top of the vertical boiler. This shaft carries the winding-barrel, F, with a small overhanging fly-wheel, fitted with a friction-brake, at its opposite end. To give the attendant the greatest possible control over the engine's movements in both directions, the shaft carries back and forward eccentrics, G, working a reversing link, H, from which a rod, I, passes downwards to the slide-valve spindle. The feed-pump, J, for supplying the boiler, is attached to the front of the cylinder, and is worked off the prolonged cross-head or connecting-rod joint-pin, K, the water-supply being taken in by the branch, L, and led into the boiler by the pipe, M.

The boiler, which is of the vertical tubular kind, is neatly contrived to answer as a pillar for the winding apparatus. It is a plain cylinder, with an inside fire-box, N, from the convex top of which spring the tubes, 73 in number, and 1⅝ inches in outside diameter, opening at their upper ends into the shallow smoke-box, O, whence the flue current passes into the chimney, P, standing up about six feet above the top of the boiler. The steam is conducted from the boiler to the valve-chest by the pipe, Q, which passes up inside the boiler to the annular steam-receiver, R; whilst the waste steam is carried off by the larger pipe, S, opening into the smoke-box.

The engineer is so placed as to be enabled to see the position of the bucket, and with the reversing handle, T, in one hand, and the brake-lever, U, in the other, he has the most perfect control over his machine. The quantity of coal lifted at once is five hundredweight, the bucket chain being passed over a derrick in the usual manner, and then wound upon the barrel, F.

The arrangement of the boiler with its vertical tubes is such, as to make it next to impossible that serious mischief can result from an insufficient supply of water, because, before the top of the fire-box became exposed, the tubes would have become so overheated, that one or more of them would burst and extinguish the fire, and so check all further chance of damage. Another advantage arising from this arrangement of boiler is, that the engine can be removed from ship to ship with perfect safety while the steam is up, since the angle which it would assume whilst being lifted, or lowered, would be insufficient, with an ordinary supply of water, to expose the tubes to any risk of being overheated, and much less, of course, the crown of the fire-box.

The engine is readily removed to or from a ship's deck, by means of a common derrick and crab fixed on a small barge. When it is suspended, and hanging over the side of the barge, the tendency to "list" is counteracted by two ballast waggons, which are moved on rails to either side at pleasure.

Although, up to this time, this engine has been used only for unloading colliers, yet it is evident that it is equally applicable for unloading almost all kinds of merchandise, and that, if carried permanently on board large ships, it might be found otherwise useful in doing much that is now done by manual labour, such as pumping, weighing the anchor, or hoisting up some of the heaviest sails.

It would appear also, that but little arrangement would be necessary in the application of so portable a machine to the lifting of heavy goods into the upper floors of the large warehouses at the docks and elsewhere. This work is now done by hand, and is, consequently, both slow and expensive, and the wonder is, that some more expeditious and economical plan has not long since been introduced. The most simple and direct means of applying steam to this purpose would appear to be, to run the engine on a line of rails laid down immediately in front of, and extending the whole length of the warehouses, and at such a distance from them, that the centre of the line of railway should be just underneath the centres of the cranes at present in use. By this arrangement it will be seen, that no machinery whatever is required within the warehouses, the present cranes being perfectly suited to the altered arrangement, and the old "falls," instead of being wound around a barrel turned by hand, would only have to be transferred to the engine placed as nearly as convenient under the crane. One engine could be moved to, and readily work either crane in the whole line of warehouses; and the risk of fire, which might be urged against the introduction of steam, would seem to be met, by placing the engine altogether without the walls of the buildings.

The fire, as will be seen on a reference to the engraving, is wholly enclosed within the boiler, as is the case in steam-boats, and the quantity required is little if at all more than is to be found in the ship's caboose.

MECHANIC'S LIBRARY.

Astronomical Observations taken during 1839-51, 12s. Bishop.
Builders' Price Book, new edition, royal 8vo, 8s. cloth. Kelly.
Cosmos: Bohn's Scientific Library, vol. 4, 12mo, 3s. 6d. cloth. Humboldt.
Design and Manufactures, Journal of, vol. 6, 8vo, 7s. 6d. cloth.
Differential and Integral Calculus, 5th edition, 8s. 6d. cloth. Hall.
Euclid, Elements of, Corrected by Maynard, new edition, 5s. Simson.
Farming of Lincolnshire, Reports on the, 8vo, 3s. 6d. J. A. Clarke.
Geography, Elements of, 18mo, 1s. 6d. cloth. J. Cobbin.
Geology, 2d edition, 12mo, 1s. 6d. cloth. Lieut.-Col. Portlock.
Hand, its Mechanism, &c., The, 5th edition revised, 7s. 6d. Sir C. Bell.
Household Chemistry, foolscap 8vo, 4s. cloth. A. J. Bernays.
Magnetism, Rudimentary (Weale's Series), part III., 1s. 6d. cloth. Sir W. S. Harris.
Mechanic's Magazine, vol. 55, 8vo, 7s. cloth.
Models of Farm-yard Buildings. Description of, 2s. 6d. Bagster.
Plane Curves, On the Higher, 8vo, 12s. cloth. Rev. G. Salmon.
Projectile Weapons of War, 2d edition, foolscap 8vo, 6s. cloth. J. Scoffern.
Wools, On Colonial Sheep and, new edition, 8vo, 12s. cloth. T. Southey.

RECENT PATENTS.

SAWING MACHINERY.

JOHN M'DOWALL, *Engineer, Johnstone.—Enrolled March* 22, 1852.

Mr. M'Dowall, so well known for his many valuable improvements in wood-working mechanism, more especially his direct-action steam saw-mills and wood-planing machines, has here brought his long experience to bear upon his subject with perhaps still more important results. The essential point of his new plans has reference to the so arranging sawing machinery, that an effective amount of tension may be given to the saw without the necessity of using the ordinary heavy saw-frame, whilst the machine may be driven at a much higher rate than at present; so much so, that he contemplates the execution of as much, or nearly as much, work with a single saw as is now accomplished by a whole frame full.

According to one of his plans, he attaches a couple of saws by their four ends to the ends of a pair of flexible bands, so as, in fact, to form an endless belt, the flexible bands or straps being passed over, and attached to, the peripheries of a pair of pulleys, set one above the other, at a suitable distance asunder, in a vertical frame. One of these pulleys works in fixed bearings, whilst the other is capable of adjustment by means of a sliding frame, so that any necessary amount of tension may be given to the two saws, by screwing up or down this sliding frame. Motion is given to the saws by an overhead pulley-shaft, which carries a crank

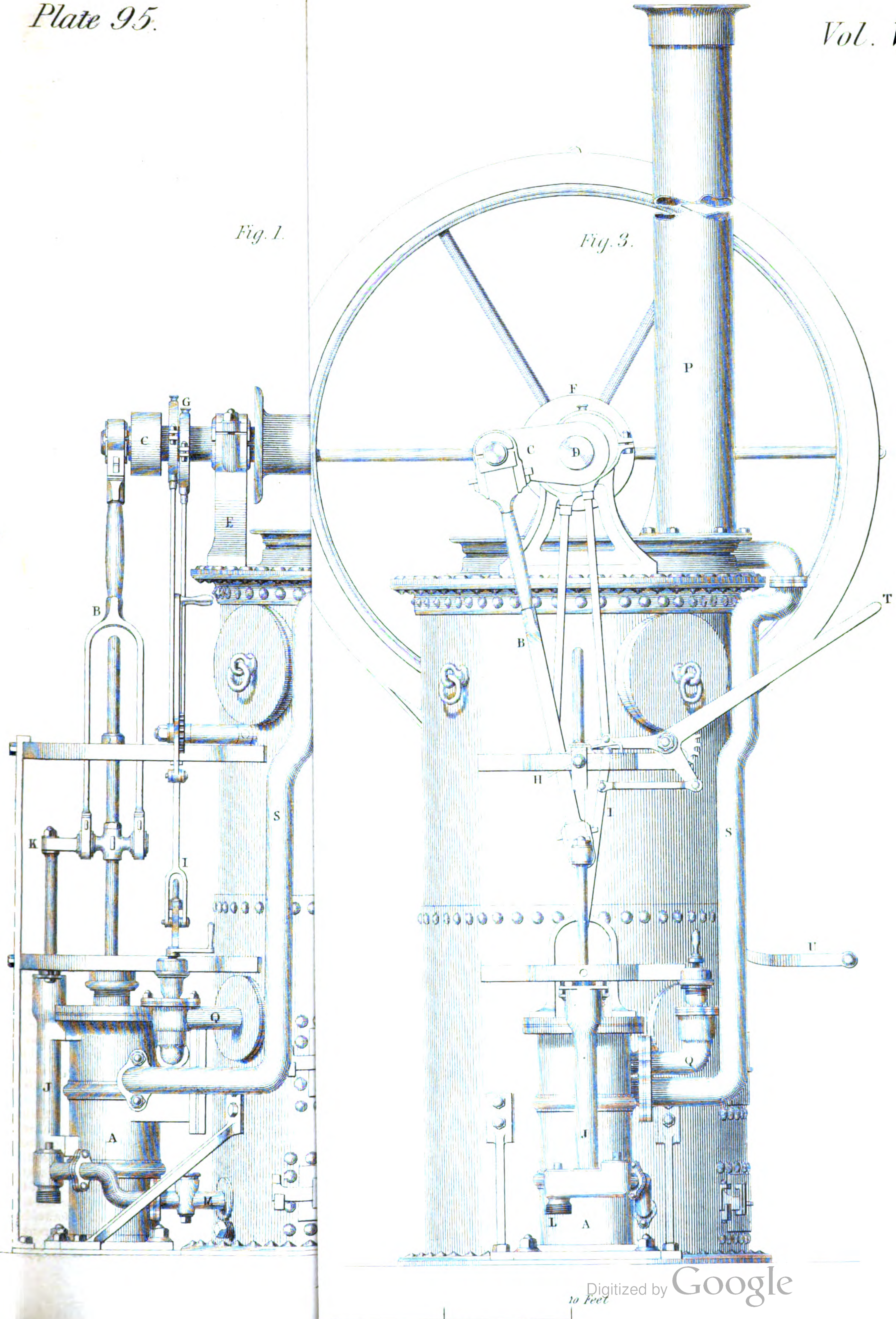


Fig. 1.
Fig. 3.
10 Feet

lever, fitted with a connecting-rod passing down to a longer crank, fast on the end of the lower pulley shaft. In this way the continuous revolution of the main driving-shaft gives a continuous series of reciprocating partial revolutions to the two saws, so that the saws are worked up and down in their vertical planes at a rapid rate. One saw being set on each side of the standard of the framing, the two cut alternately, and two distinct operations may thus be carried on. The "overhang" or "rake" of the saws is capable of a beautifully accurate adjustment, by means of what the inventor terms his "adjustable buckle," whereby the upper end of the saw may be set back or forward by a screw, fitted with an index to point out the exact set.

By this system of giving tension to the saw, all the heavy reciprocating mechanism of the ordinary saw-mills is got rid of, and the saws may be worked at an extraordinary rapid rate. Mr. M'Dowall also shows some additional plans of giving tension, partly by the direct action of steam cylinders; but as we mean to illustrate the entire series of improvements on an early occasion, we shall meanwhile content ourselves with simply introducing what appears to be the most important improvement in the sawing machinery of modern times.

PROPELLING MACHINERY.

J. Grindrod, Birkenhead.—*Enrolled February* 14, 1852.

The main feature of this invention, which was patented under the title of "Improvements in the machinery for communicating motion

Fig. 1.

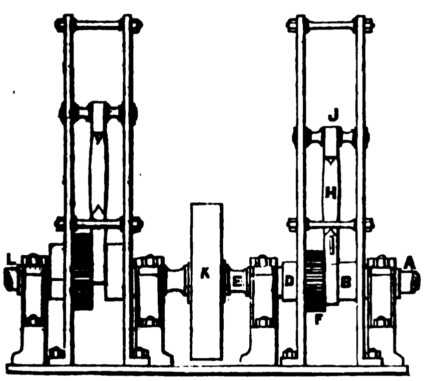
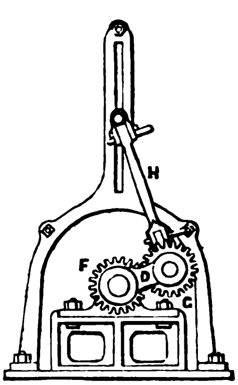
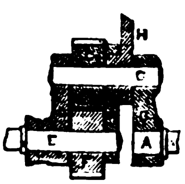


Fig. 2.



from steam-engines, or other motive power, and in the construction of rudders for vessels," consists of a modification of the "sun-and-planet" motion, and called by its inventor an "accelerator." His object, as more particularly referring to the driving screw-propellers, has been to secure a simple variable speed of the shaft, without the ordinary expedient of large wheel and pinion gearing, involving the necessity of separate shafts. By combining the sun-and-planet motion with the crank, he obtains a direct connection, in one unbroken line, between the first motion shaft of the engine, and the driven shaft of higher velocity. Fig. 1 represents a side or longitudinal elevation of two "accelerators" combined, as applied on board a screw steamer, to obtain a speed of four to one. Fig. 2 is a corresponding front view, looking in the direction of the axial line of the shaft. Fig. 3 is a section through a pair of cranks and corresponding sun-and-planet movement. The end, A, of the line of shafting may be supposed to be the first motion or crank-shaft, going at the rate of the engine or prime mover, a crank, B, being fast upon its end, as better shown in fig. 3. The pin, C, of this crank is of considerable length, its opposite end being entered into the eye of a corresponding crank, D, loose on the end of the second motion or driven shaft, E, in a line with the shaft, A. The end of the shaft, E, projects through the boss of its loose crank, to carry a toothed pinion, F, in gear with a corresponding pinion, G, loose on the crank-pin, C, between the two cranks. Then, as a guide to the pinion, G, its boss has bolted to it the lower end of a connecting-rod, H, the upper end of which terminates in a cross-head, J, working in vertical guides, like the connecting-rod of a steeple-engine. The effect of this is, that the pinion, G, is kept from revolving on the crank-pin, whilst it revolves round the pinion, F, as a centre, giving the shaft, E, double the velocity of the shaft, A, as in the ordinary sun-and-planet action. If any balance weight is necessary, an eccentric or weighted wheel, K, may be placed on the driven shaft. The second arrangement is precisely the same as the first, and the driving-shaft of this motion having already attained twice the speed of the prime mover, its speed is again doubled at L. In the section, fig. 3, a slight modification is introduced, in the strap or connecting link, M, which is added, in combination with the cranks, to afford a support to the overhanging end of the shaft, E. By strengthening the guides of the cross-head, H, they may serve as well for the guides of the engine piston-rod. The accelerator may be used independently of the engines in screw steamers, and fixed on any part of the shaft. If at the extreme end, next the propeller, then the whole line of shafting up to it will travel at the slow rate of the engine. In case of accident to the teeth, the pinions may be locked together by toothed straps, and the connecting-rod being disconnected, the line of shaft will work at the engine's rate.

Fig. 3.



The patentee intends also to apply it to locomotives, a purpose for which the sun-and-planet motion has been long ago very unthinkingly proposed.

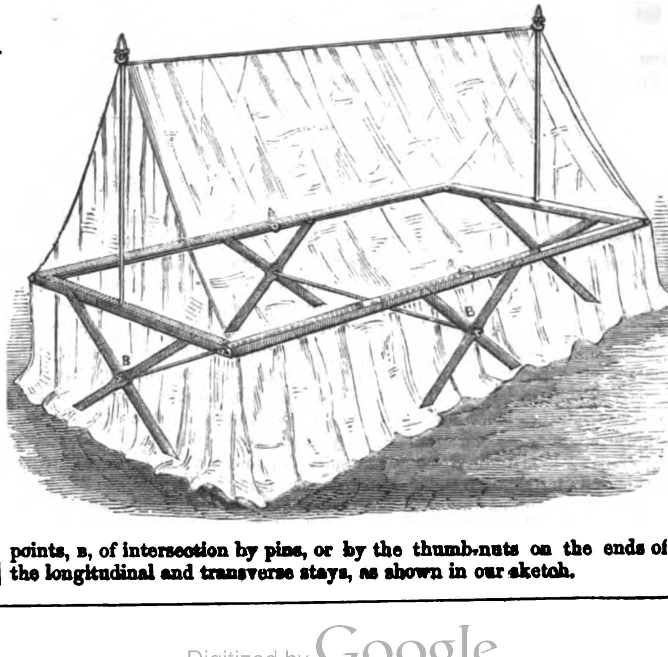
The improvement in rudders relates to the so arranging them, that they shall not be so liable to injury on the vessel's striking the ground. In carrying out this plan, he employs two separate, or starboard and port rudders—a project in which he has been forestalled by Capt. Carpenter.

PORTABLE BEDS.

John Blair, Esq., *Irvine.*—*Enrolled March* 10, 1852.

Military men and travellers will highly appreciate the result of Mr. Blair's labours, when they find he has supplied them with so useful a piece of furniture as his really portable bed. By using angle-iron for the main framing, he at once secures very great strength and lightness, whilst the space included between the flanges of the angle-iron admits of packing the supporting legs and other details therein. Our perspective view, fig. 1, has been selected, not as the best of Mr. Blair's plans, but as the most suitable for conveying an idea of the general arrangement. It is represented as fitted with a mosquito curtain. Each side piece of the frame is composed of two pieces of light angle-iron, jointed at A, by a "rule joint," opening horizontally or inwards, towards the centre of the bed; this plan of joint being chosen for its great resistance to lateral strain. Each end of these side pieces is connected to transverse pieces of a similar section of iron, the corner junctions being made flush, by cutting away one flange at each overlap, whilst the flanged ends for the connections are bent down out of the angle-iron itself, to receive rivet-jointed buttons, the flat heads of which hold together the two ends, by entering into, and crossing over, slots in the corresponding frame-pieces. This forms a very effective joint, without involving any loose screws or pins, which are invariably missing when wanted. The frame is supported by four diagonal legs, formed out of thin flat bars, rivet-jointed to the frame, and connected together at the

Fig. 1.



points, B, of intersection by pins, or by the thumb-nuts on the ends of the longitudinal and transverse stays, as shown in our sketch.

When taken down for transport, the two side pieces being folded on their central joints, their legs are folded down into the angular recesses of the frame, which also receive the two end frame-pieces with their legs similarly folded, the whole, when laid together, forming a compact bar, as it were, of about 3 feet in length, by $2\frac{1}{4}$ inches square.

Amongst the many detailed modifications shown in the patentee's drawings, are various modes of effecting the junction of the frame-pieces and legs. The details, figs. 2 and 3, for example, exhibit a plan for con-

Fig. 2.

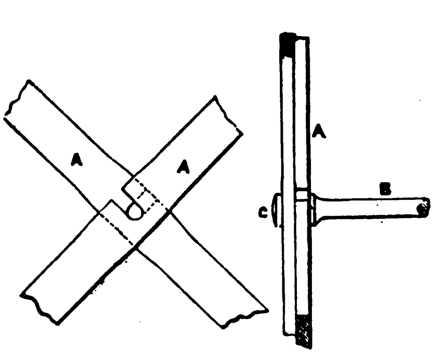
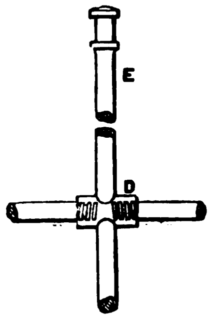


Fig. 3.



necting the legs without pins at all. The legs, A, are slotted out on one side, so that the end of the stay, B, when passed into each slot, forms a firm connection, by its collar and head, C, as in fig. 3. The transverse stay, E, has an eye, D, formed at its centre, screwed to receive the ends of the two halves of the longitudinal stay, B. Thus portability is given to what would otherwise be an inconvenient portion of the framing.

Fig. 4.

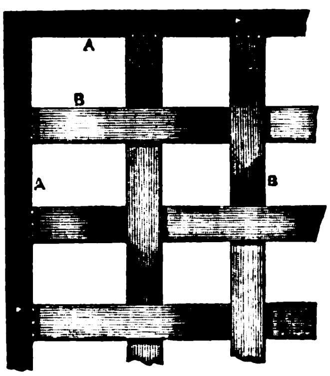


Fig. 5.

Fig. 4 is a plan, and fig. 5 a transvere section of a corner of a bed-frame, showing a mode of attaching gutta percha or metal bands for the support of the bedding. Here A A is the framing, in the upper flange of which a row of holes is made at regular intervals, the interlaced bands; B, being fitted with hooks, C, to enter these holes. According to another plan, the ticking is fitted with rows of hooks to catch on the under side of the vertical flanges of the main frame.

We can here only present a faint outline of the invention, which promises to supply an important want for all who are subjected to the discomforts of houseless wanderings.

WATER-METERS.

T. Kennedy, *Kilmarnock.—Enrolled March* 29, 1852.

The object of Mr. Kennedy's invention has been long aimed at, and the history of the attempts at its accomplishment would furnish a curious and instructive list of failures—silent pioneers of improvement. We refer to the accurate measurement of fluids under pressure, without any interference with that pressure in passing the fluid through the measuring apparatus. This effect is arrived at by Mr. Kennedy in a very simple manner. He passes the fluid through an adjustable valve, working in connection with an arrangement of clockwork, the combination being so contrived that the exact flow of the liquid shall be indicated by apparatus worked from the clock movement. In one arrangement, the valve on the supply-pipe consists of a small bored cylinder, fitted with a piston, and having a narrow longitudinal slot on one side. Then the water being admitted to this cylinder beneath the piston, escapes through this slot into an outer cylinder, communicating with the service-pipe or delivering stop-cock, at a rate proportioned to the extent of slot left open to the water by the piston. When placed vertically, the piston-rod is loaded with a weight, to keep it steady upon the water, the rod being passed though a stuffing-box at the top of the outer cylinder, above which it is connected to a traversing pulley, which is kept constantly revolving by contact with a cone pulley, driven at a continuous uniform rate by a common clock. The result of this combination is, that as the piston rises in its cylinder, admitting an increased flow of water, it draws the traversing pulley towards the larger end of the cone; and this pulley being connected to the indicating mechanism, at once points out the quantity of water passing through, as it is driven at a more or less increased speed, from its position nearer to, or further from, the large end of the cone.

Various modifications are detailed in the specification of the patentee. These, as well as the general merits of this ingenious invention, we shall shortly discuss very fully.

REGISTERED DESIGNS.

SELF-BALANCING DOG-CART.

Registered for Mr. G. Thomson, *Carriage-Builder, Stirling.*

This design, which has been registered under the title of an "Apparatus to keep a carriage body in equilibrium under different circumstances of use," refers to that class of vehicles where passengers are or may be carried both before and behind the axle—the "self-balancing" action being secured by causing the body of the carriage to be moved forward, by the mere act of opening the foot-board when passengers are to be received on the back seat. Similarly, the closing of the foot-board effects the setting back of the body when the foot-board is closed, to suit the vehicle for conveying front passengers only.

The movement is effected by the two span irons, one on each side, attached to the shafts at one end, and to the foot-board at the other. The irons work on centres inside the shafts or frame, and when the foot-board is put up out of use, they move up along with it, and stand outside the body. They also work on a piece of iron fast on the foot-board, and rest on the ends of the cross bars supporting the body, thereby carrying the foot-board when in use, and doing away with the usual straps employed for that purpose. The body moves on back and front antifriction rollers, by means of small frame guides, secured to the under side of the shafts, the body resting on two cross bars, which are prolonged beyond the body, each end receiving one of the rollers. It will be seen that this automatic balancing action entirely obviates the existing necessity for attention to the pin and hole, or screw-traversing plans at present resorted to.

EXPANDING CAP.

Registered for Messrs. J. & T. Todd, *Booth's Green Factory, Canonmills, Edinburgh.*

The "Expanding Cap" is a simple and cheap modification of the common cloth, or other cap, whereby one size of cap is made to be capable of adjusting itself to any size of head. Our illustrative

Fig. 1.

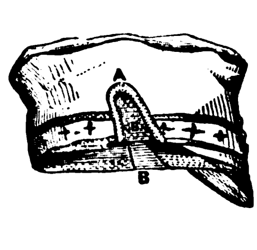
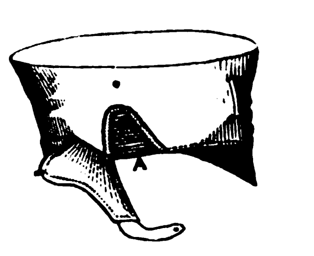


Fig. 2.



figures represent the design as carried out under two slightly different forms, wherein the power of elasticity is given to the two opposite sides of the cap. These sides have each a small piece cut out of them as at A, in which opening, or notch, is inserted a piece of elastic vulcanized india-rubber webbing, B. In this way, that portion of the cap which fits tightly to the head, is capable of extension to any moderate range of sizes of heads, as the elasticity so given affords a perfect self-acting adjustment.

Fig. 2 is another example of the same design, wherein the elastic portions, A, are covered by a back fold, or side flaps. The elastic material may be variously applied; as, for example, in the Glengarry bonnet, it may be inserted in the tie behind.

DOMESTIC GAS APPARATUS.

Registered for Messrs. Henry Field & Son, *Ironmongers, Buchanan Street, Glasgow.*

The soft brilliancy of the light from hydro-carbon gas, with the simplicity of the manufacturing apparatus, are powerful arguments in favour of its extensive adoption. Our readers may gather from our illustrations of Messrs. Field's compact "domestic gas apparatus," how easily manageable such contrivances may be made.

Fig 1.

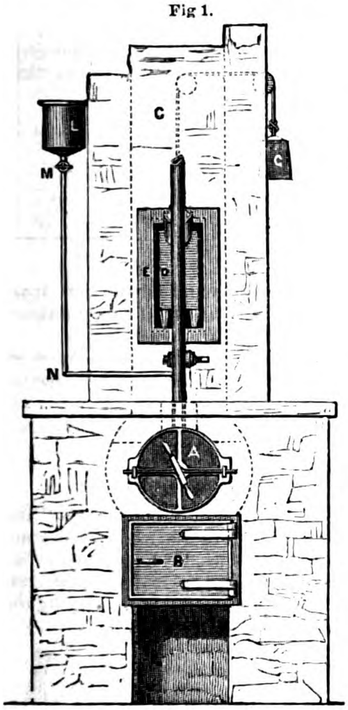
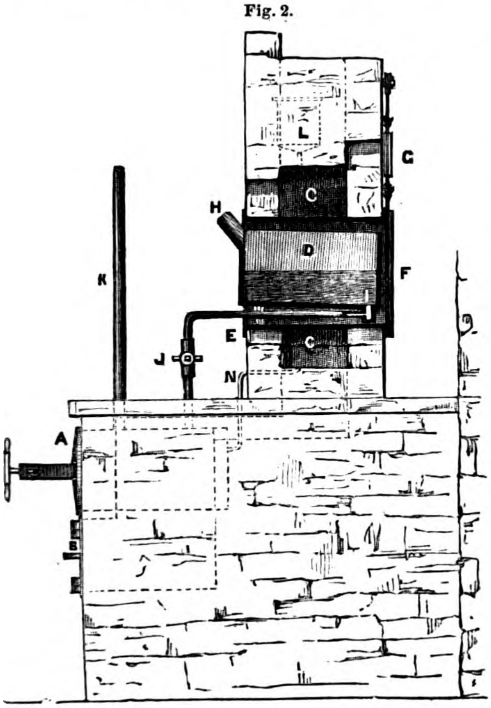


Fig. 1 of the engravings represents a complete front elevation of the gas-generating apparatus, detached from the condensers and gas-holder. Fig. 2 is a corresponding vertical section of the upper portion of the apparatus, at right angles to fig. 1, with the base or lower portion, containing the retort, in elevation. The retort, A, is set in brickwork, in the usual way, and is heated by a common furnace, B, beneath. A vertical flue, C, springs from the extremity of the furnace, serving as well to promote the furnace draught as to heat the resin or other matter, which is placed in a cast-iron chamber, D, set in the centre of the flue. To hold the chamber in position, a rectangular flanged chamber or frame, E, open at both ends, is first built into the flue, projecting through from front to back, leaving sufficient space on each side for the furnace draught, as indicated by the dotted lines in fig. 1. In this is placed the resin chamber, slightly elevated on bottom projections or feet, and inclined a little towards the back of the flue. A damper is fitted at F, behind the flue, commanding the outlet through from the space between the exterior surface of the chamber, D, and its containing chamber, E. This damper is supported by the counterweight, G, and by it is adjusted the passage of a current of air for cooling or regulating the temperature of the chamber, D. The resin or other matter employed in making the gas, is placed in the chamber, D, being supplied as required by the inclined mouth, H, in front. When melted by the heat of the flue, it flows off by the outlet, I, and through the pipe beneath to the retort, the supply being regulated by the stopcock, J. As the distillation goes on in the retort, the gas flows off by the front vertical pipe, K, by which it passes through the condensers to the gas-holder. Whatever residual oil is collected from the condensers is redistilled, by being placed in the elevated receiver, L, whence it descends through the regulating-cock, M, and pipe, N, to the inner end of the retort, to be again used in the production of gas. By this arrangement, the resin is heated preparatory to its supply to the retort by the waste heat from the retort flue, without any additional heating apparatus, as ordinarily used, whilst the arrangement of the inner and outer chambers, D and E, and the damper, F, admits of an easy regulation of the temperature of the fluid resin in the chamber, D, being readily cooled down to any required degree by the air current passed over its external surface. The adaptation of one furnace for the two purposes of melting the resin and making the gas, is an important point, which Messrs. Field have well carried out in the design before us.

Fig. 2.

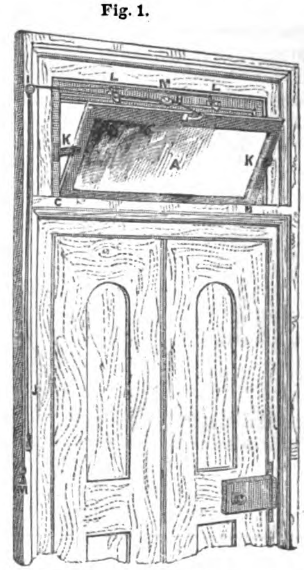


INDUCTION VENTILATOR.

Registered for Mr. John Finlay, *Ironmonger, Buchanan Street, Glasgow.*

Mr. Finlay, who has earned considerable local reputation in carrying out the practical ventilation of dwelling-houses, has recently introduced his "Induction Ventilator," with the view of securing a more "effective self-acting induction ventilation," without involving anything beyond the simplest mechanical arrangements. Our engravings represent two combined views of several details of this simple contrivance. Fig. 1 is a perspective elevation of the upper portion of a door, as fitted with a ventilating fan-light, open to its fullest extent. Fig. 2 is a side and end view of one of the eccentric or counterbalanced hinges for carrying the fan-light. The ventilator, A, is hinged by its lower edge at B, C, to the framework above the door. These hinges are attached by brackets, D, arranged to screw to the face and inner edge of the framework respectively, for convenience in putting up. The hinge-pieces, E, work in eyes in the brackets, by means of joint-pins, F, set parallel with one edge of the pieces, E, so that, when the latter are screwed on, they have an eccentric action; and the centre of gravity of the fan-light being thrown to one side, the ventilator has a constant tendency to remain open. In this way a simple self-acting opening action is secured, the shutting being effected by a cord attached to a bracket, on the upper side of the ventilator, and passed thence over the fixed guide pulleys, H and I, and down behind the door to J, where it may be actuated at pleasure, to give any required amount of opening to the ventilator.

Fig. 1.



Small brackets are provided at K, for supporting the ventilator when open. To keep it closed the short adjustable catches, L, are used. These catches work on fixed centres, their upper ends having eyes to connect them with a cord, M, passing over the guide pulley, I, to be worked alongside the other cord at J. When the ventilator is closed, the inclined edges of the levers, L, allow the ventilator frame to pass them, when they fall, and hold the frame vertically; but the moment the cord, M, is drawn down, the levers are raised, allowing the ventilator to open.

Fig. 2.

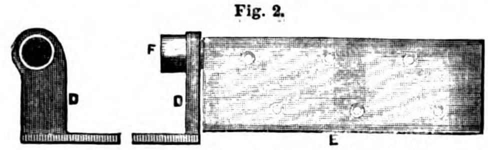


Fig. 3.

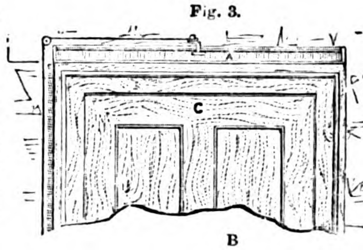


Fig. 4.

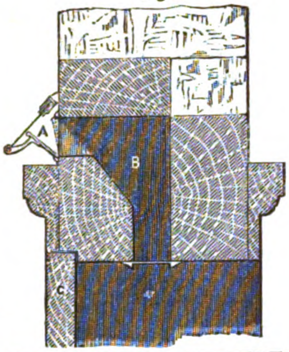
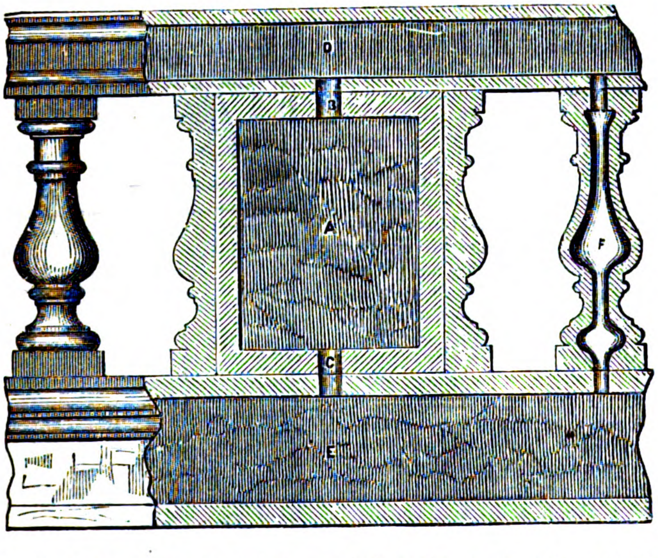


Fig. 3 is an elevation of the same species of ventilator, as applied to an inner door; and fig. 4 is a transverse section of the fittings. In these figures, A is the ventilator in its open state, guarding the air passage, B, immediately over the door, C, which is closed. This arrangement affords a very easy means of regulating ventilatng passages, and with very inexpensive apparatus; whilst it presents no prominent indications of any special provision for the very important purpose which it fulfils.

HEATING APPARATUS FOR HOTHOUSES AND GREENHOUSES.

Registered for the Grangemouth Coal Company, *Grangemouth, Falkirk.*

This elegant contrivance is the production of the very extensive fire-clay works of the Grangemouth Coal Company, on the margin of the Frith of Forth. Our engraving represents the "heating apparatus,"



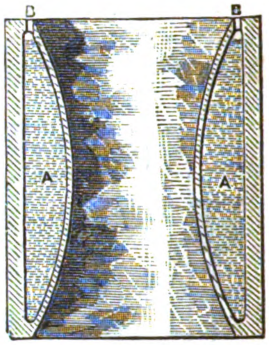
partly in elevation and partly in vertical section, so as to show clearly the object of the design, which is, to secure the effective conduction of heat throughout the house by an arrangement in itself highly ornamental. This is accomplished by making an ornamental balustrade answer as the conducting flue or flues, the material of which the balustrade is made being fire-clay, an excellent material for the purpose. In our illustration, A, is the main flue or artery of the heat, whether air or other medium, the heated current being made to pass through the upper and lower openings, B, C, into the upper and lower horizontal flues, D, E, which are formed in the coping and base of the balustrades respectively. Communication is also kept up at regular intervals between these two flues by means of minor branch flues, formed by the hollow ballustrades, F.

In this way a very effective heating surface is secured, in combination with unsurpassable elegance and simplicity of form.

LAMP GLASS.

Registered for Mr. A. H. Ross, *Optician, and* Mr. R. Henderson, *Miner, Sunderland.*

This ingenious and simple contrivance is an important addition to the miner's safety-lamp, so much objected to for the dimness of its light. It may be defined as a double glass-cylinder, jointed at top and bottom, the interior surface being curved, as shown in our figure, which is a vertical section of the glass. The outer surface is a plain cylinder, so that when the space between the two is filled with water, as at A A, by means of the upper apertures, B B, the cylinder acquires, to a certain extent, the magnifying properties of a plano-convex lens, adding very much to the brilliancy of the light which it may surround.



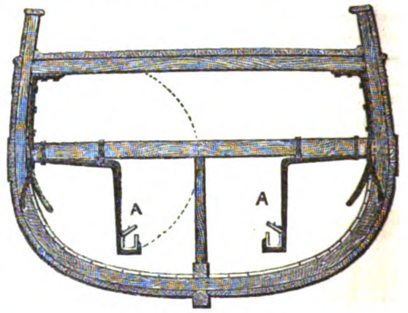
As any coloured fluid may be supplied to the enclosed space, the glass may be easily adapted for purposes of ornament, as, for example, in the windows of chemists' shops. But it is in the coal mine where its real use is to be felt, for it may be fitted to the Clanny, or other safety-lamp; and whilst it will afford a light superior to that obtainable from any existing lamp of the kind, it involves a far greater degree of safety. This is clear from the obvious inference, that although the external cylinder may be broken, the inner one may stand and preserve the flame from contact with the inflammable atmosphere.

Mr. Henderson, who is associated with Mr. Ross in the invention, is a working miner, to whom great credit is due for many improvements in the details of the safety-lamp.

REVERSE LEVERS FOR SHIPPING.

Registered for Mr. E. Poulson, *Sunderland.*

What Mr. Poulson terms his "Reverse Double-action Levers," are intended "to enable light ships to sail with two-thirds less ballast than is usual, and greatly to assist their sailing qualities." The plan also contemplates the enabling of crank ships to shift without ballast, as well as to keep them from shifting their cargoes in bad weather. Our figure represents a transverse midship section of a vessel so fitted.



1-16th in. = 1 foot.

The levers, A, are hung by straps to the under side of the lower deck or hold beams, so as to bring them as near the level of the light water-mark as possible. Then, the ballast being on the arms of these levers, if the wind is on the starboard side or beam, the port side will of course be brought down in the water, and, consequently, the gravity at the lower end of the levers, next the bottom of the ship, will simultaneously press up to windward both the lee and the weather levers with equal force. The levers are attached at their elbows by a hanging clamp, and their fulcrum is, at the end of their horizontal arms, shipped into a travelling strap at the beam end. The ballast is hung to the vertical arms of the levers in wooden troughs, extending as far fore and aft as may be necessary. With twenty or twenty-five tons of ballast in the hold, two or three tons may be placed in the troughs, in order to gain the effect, as the inventor states, of ninety tons placed in the usual way, whilst the vessel will be stiffer. By this arrangement, it is presumed that, in summer weather, colliers will not require ballast, as a few fakes of their spare chain cable, laid in the boxes or lever troughs, will answer all requirements.

Ships of 250 or 300 tons will require three levers on each side, and larger ships in the same proportion. The levers are capable of being unshipped with facility, when they, together with their troughs—which may either be mere planks laid together, or two pairs joined at right angles—may be easily stowed away, so as to take up very little of the room available for cargo.

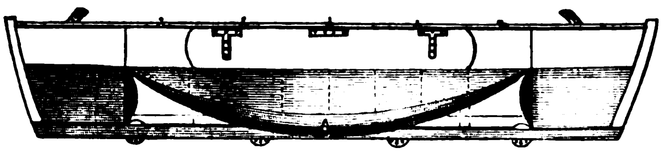
Mr. W. Pile, an influential ship-builder of Sunderland, is building a handsomely-modelled clipper barque, of about 400 tons, to be fitted with these levers. Her limber-boards are of metal, cast in two pieces, so that two hands may ship them. There are ten on each side of the barque, making in all 5 tons, equal to the effect of 60 tons of ballast. Being sharp built, and with a good keel to hold the water, she will be weatherly and shelve well to windward.

LIFE-BOAT.

Registered for MR. E. POULSON, *Sunderland.*

Mr. Poulson is also the inventor of a life-boat, for which he claims a power of resistance against all chances of upsetting in the worst weather. Figs. 1 and 2 are, respectively, a side view and plan of the

Fig. 1.



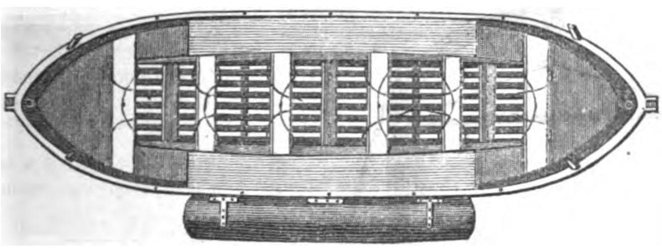


Fig. 2.

boat; fig. 3 is a half transverse section; and fig. 4 is a complete transverse section, illustrative of the effect of a side wind. Her dimensions are:—Extreme length, 30 feet; length of keel, 27 feet; breadth of beam, 8 feet 3 inches; depth on sheer to gunwale, 5 feet. Her ballast is an iron keel of 5 cwts., being hung with the inventor's "double-action levers." She is carvel-built of cedar, and has cork sheeting on her bottom, as at A, in fig. 1; also indicated by the dark portions in the sections, figs. 2 and 3. By forming the grating in her flooring in a peculiar manner, wide next the water, and overlapped by curved portions on the inside, water is, to a great extent, prevented from coming in by the lodgment of the air in the overlaps, whilst no hindrance is given to its exit. Her outriggers are self-acting, so that the lee one will be out and locked, whilst the weather one is shut and locked, to hold no wind.

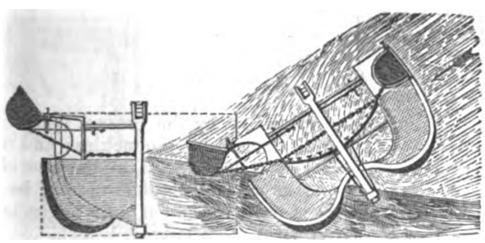


Fig. 3. Fig. 4.

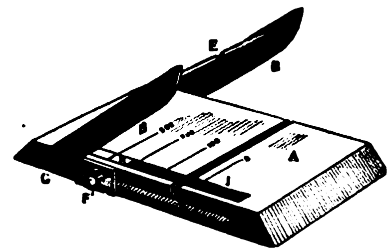
Mr. Poulson, as a seaman, affirms that no sea ever capsized a boat; but that it is the effect of the wind. His theory is illustrated in fig. 4, where the arrow indicates the direction of the wind. If it were possible for a sea to strike a boat with such force as to capsize her, it is presumed that the blow would dash her in pieces, as it would be sharp and dead, and its effect is then gone. But, in reality, a topping, rolling sea strikes the broadside, raising the boat at the same time, and the sea coming over the weather gunwale into the boat, and rolling to leeward, whilst that which struck her recedes, she naturally settles down to windward, even if swamped, for the effect of that sea has passed; but being on her beam ends, the wind rebounds from the sea, under her bottom and keel, like a wedge, and she capsizes by the wind catching her as she is righting.

ELEVATION SIGHT FOR BALL SHOOTING.

Registered for HENRY MALING, ESQ., *Home Office.*

The prolonged discussion of the chances of our invasion by foreign powers will hereafter be referred to in the yet unwritten history of our times, as the parent of a vast range of improvements in the science and mechanism of projectiles. Never were our newspapers so eloquent on "two-grooved rifles," "needle-guns," and "Minié" ammunition; never have we listened to such details of marvellous ranges, or such accurate execution. The latest contribution in this class of invention is Mr. Maling's "elevation sight," of which we give a perspective view.

A rectangular dovetailed piece of metal, A, fits into a corresponding slot, formed transversely across the breech of the gun; if a double-barrelled one, the sight is placed between the barrels. Two arms, B, are hinged at C, to the sides of the piece, A, by a pin which passes transversely through it. The opposite extremities of these arms are connected by a thin steel pin, D, and in the centre of this is formed—constituting the "sight" pin—a small notch, E. There is also a small metal slide, F, which is fitted with a projection or knob, for the facility of sliding it along the slot, G. Another slide, H, working in the slot, I, and connected with the outside slide, F, acts as an indicator to the graduated scale on the surface of the plate. When the instrument is not in use, the slide, F, is drawn back in the slot, G, and the arms, B, are then depressed, thereby bringing the cross wire or pin, D, into the corresponding transverse groove, J, which effectually protects the sight from injury. But when a correct aim is required at a longe range, the sight is elevated to the requisite height by pushing forward the slide, F, which, coming in contact with the incline on the end of the arms, B, raise them accordingly. The amount of elevation required for certain given distances, is plainly indicated by the graduated scale on the plate, A.



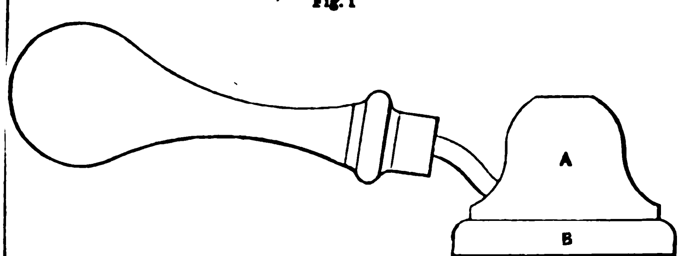
The sight obviously provides for very great accuracy, whilst it cannot be objected to for being so simple in mechanical arrangement.

BULLET MOULD.

Registered for DR. BUCKNILL, *Exminster, Exeter.*

Dr. Bucknill's mould is intended for casting hollow cylindrical and solid conical bullets, either for a smooth or rifled barrel. Fig. 1 repre-

Fig. 1

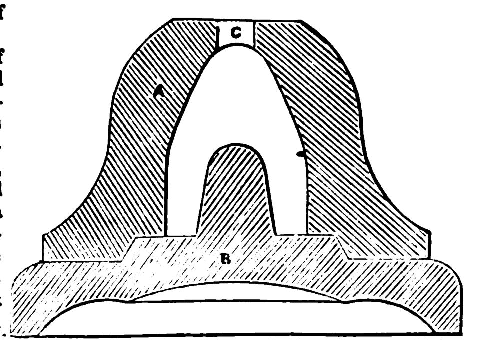


sents a half-size side elevation of the mould complete; fig. 2 is a vertical section of the mould, with its base, as detached from the handle; and fig. 3 is a section of a bullet cast in it—both being full size.

The presumed advantages obtained by this new form of mould are—

1st. Facility of construction, and consequent cheapness. No joint is required, and the cavity in the matrix, A, is accurately and rapidly formed by a boring-tool, thus enabling a good article to be sold for less than one-half the cost of a good mould on the old construction.

Fig. 2.



2d. A more symmetrical and accurate casting is produced.

3d. The operation of casting is carried on with great ease and rapidity; and the handle being of wood, enables the work to be continued long after the mould has become too hot to be touched.

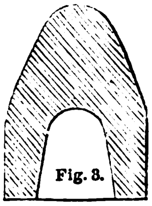


Fig. 3.

In casting, the lead is to be used as cool as possible, striking off the button of lead left above the orifice, c, with a chisel; then, by lifting up the matrix, and giving it a slight tap, the bullet falls out.

The figures represent the new principle as adapted for casting the Minié bullet; it can also be adapted for casting ribbed and solid bullets for rifles, with two or more grooves, by altering the shape of the base, B, and having chases in the matrix.

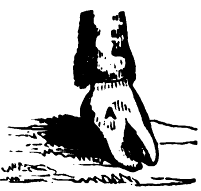
GUTTA PERCHA GOLOSH FOR SHEEP.

Registered for Messrs. John Jones & Co., *Sheffield*.

If not too costly in manufacture and management, this contrivance will be found very serviceable in preventing the foot-rot in sheep on cold wet land. Fig. 1 shows the golosh as placed loosely on the foot, ready for fastening, as indicated in fig. 2. The golosh, A, is formed to the shape of the animal's hoof, but with a plain cylindrical opening for its insertion, as in fig. 1. Its upper part is first dipped in warm water, so that, when placed on the foot, it may be pressed round what may be termed the ankle of the animal, to give it a firm hold, and prevent its coming away until either worn out or again softened by heat.

Fig. 1.

Fig. 2.



LACON'S SYSTEM OF SUSPENDING AND MANAGING SHIPS' BOATS.

The lamentable accidents to the *Orion* and *Amazon* steamers have had the usual effect of such disasters, in startling the public into a comprehension of the sad inefficiency of the existing arrangements for the management of ships' boats. Slender as is the chance of escape from a burning or foundering vessel by the boats, that chance should at any rate have the advantage of everything that human foresight can devise for its improvement. Of the many suggestions which observant and thinking minds have latterly thrown out, we have to draw especial attention to the inventions of William Stirling Lacon, Esq., H.C.S., of Great Yarmouth, who has recently patented his plans both in this country and on the continent.

The manner in which he overcomes the difficulties hitherto attendant on the lowering of ships' boats during tempests, on dark nights, and at periods of excitement and danger, is by suspending the boats from chains or ropes, which pass over the davits of the ship, and thence down to a winch or windlass, round which they are wound, but attached thereto in such a manner, that, when the winch is free to revolve, the ropes or chains will unship or disengage themselves from their attachment by their own weight. By this means he prevents the possibility of the ship, in its onward progress through a rough sea, dragging forward a lowered boat, and capsizing or swamping it, the weight of the chains or ropes, leaving out of the question the resistance of the boat, being sufficient to disconnect them from the winch, and thereby render the boat free of the ship.

Fig. 1.

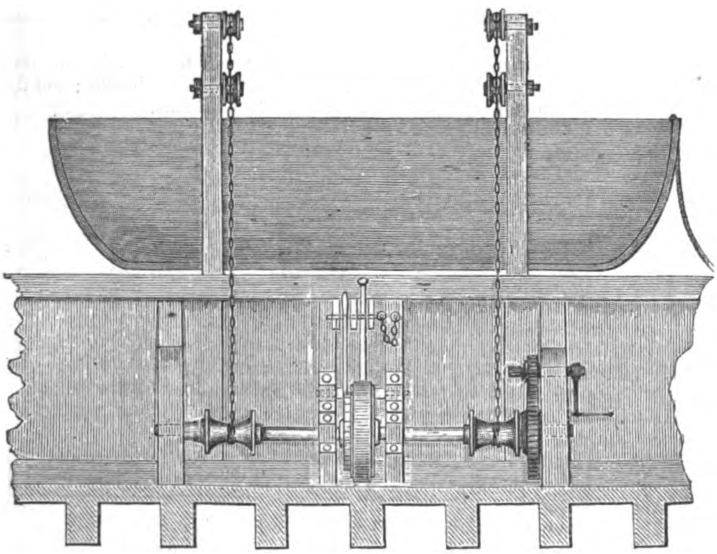
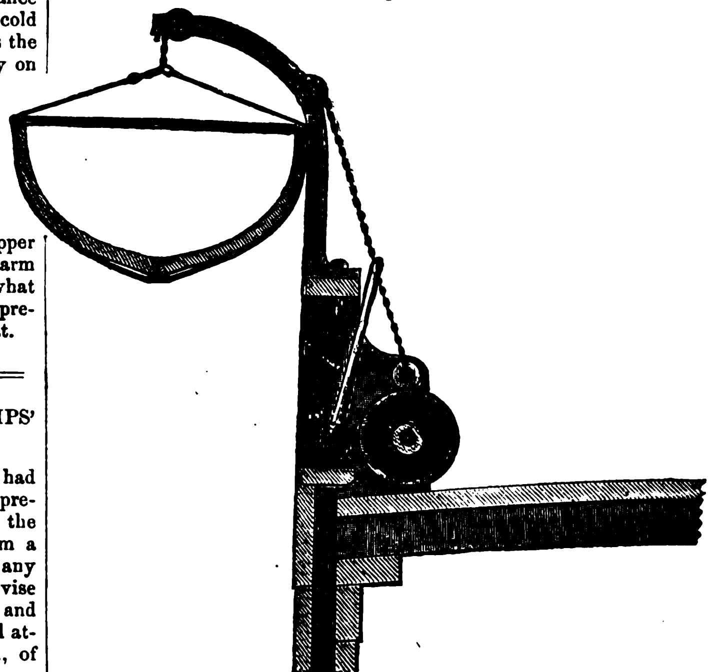


Fig. 1 represents a side view of a boat suspended in this way, from the davits at the side of the ship, the view being taken from the deck, on which the lowering apparatus is fitted; and fig. 2 is a transverse section of the same.

Fig 2.



The danger of getting boats into the water by the present system, arises from the difficulty of disengaging them from the tackles; and it must be evident that the danger will be greatest in the case of boats hanging from the stern, or stowed upon the sponsons; because, the former (in lowering) strike the water at right angles to the course of the ship, the latter at an angle more or less oblique.

Mr. Lacon, therefore, proposes, that after a boat has been hoisted up as usual with tackles, two broad slings, having a ring at each end, shall be passed round and underneath the bow and quarter of the boat; and as regards each sling, the inner ring shall be secured to a suspending chain*, to be used as afterwards described, and the outer or unattached ring shall be temporarily secured to the chain by lashing. The suspending chains he brings over friction sheeves on each davit, and carries the end of each to concave barrels at the opposite ends of a small shaft, having a ratchet-wheel and a large friction pulley in the centre, the latter embraced by a friction-strap or gripe (as in fig. 3), the ends of which are jointed to a lever which works on a fixed fulcrum; and at one end of the shaft is a cog-wheel, into which gears a pinion mounted on a short shaft provided with a winch-handle—the whole apparatus having its bearings in standards upon the deck. If desirable, the winch may be dispensed with, and the shaft with the friction pulley and barrels may be fitted under or outside the bulwark, or outside and under the taffrail. On each barrel, projecting from its periphery, there is a pin, over which the last link of each chain is to be placed.

If now the slack chains are hove in by the handle of the winch, and a pall or click fixed in the ratchet-wheel to prevent the revolu-

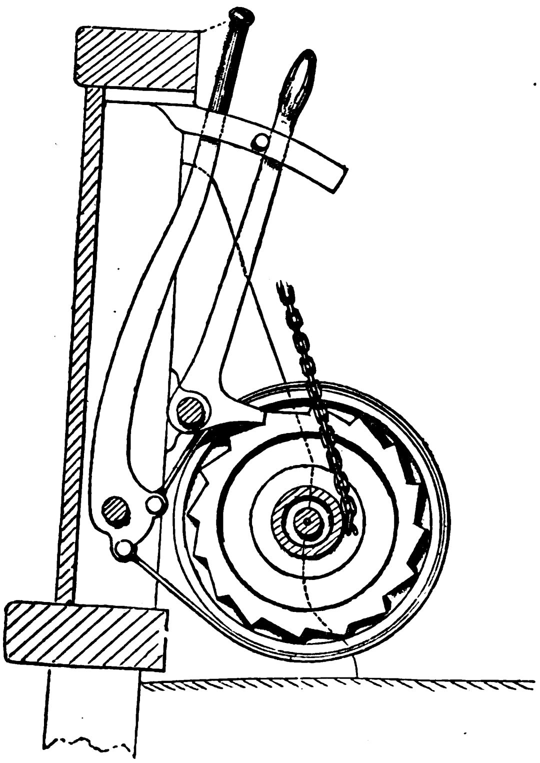
* In circumstances where it may be preferable to do so, a rope may be substituted for a chain.

tion of the barrels, by means of a lever, the friction-strap or gripe set taut by means of its lever (both levers being secured in their places by means of a bolt), and the winch thrown out of gear, the tackles may be unhooked and taken away.

It is proposed that a painter shall be attached, at all times, by one end to the bow of the boat by two half-hitches, and by the other by two half-hitches to the ship,* and that the "nose-lashings," and the lashing of the "gripes" or "flat belts for steadying" the boat when secured at sea, shall be passed round small timber heads on the bulwark, instead of, as now, lashing them to eye-bolts in the ship: they may thus easily be thrown off, cut, or let go.

Whenever the order may be given to lower a boat, two men, having thrown off the "nose-lashing" and the lashing of the "gripes," will get into the boat, and having cast off some of the turns of the lashing of the slings, will hold the ends in their hands in readiness, while a third man will take his station at the lever of the friction-strap or gripe. When the men in the boat are ready, the man inboard, withdrawing the bolt, pressing forwards the lever of the friction-strap or gripe, and lifting the pall from the ratchet-wheel by throwing back its handle or lever into a self-acting catch, may, by regulating the action of the friction-strap,

Fig. 3.



lower the boat slowly or quickly, irrespective of any weight that may be in her; and when the boat reaches the water, if the men in the boat let slip the lashing of the slings, the boat will be clear, and the slings and chains may be hove back into the ship by means of the winch.

But in cases of emergency, when, either from the rapidity with which the ship may be going through the water, from a heavy sea, through want of time, or from people rushing into the boats, it may be dangerous to cast off the lashing of the slings; or if, in attempting to let go the lashings of the slings either of them should foul, then, if the friction strap be slackened when the boat reaches the water, the weight of the chains and the resistance of the boat will pull round the barrels, and the ends of the chains not being fast, will slip from off the projecting pins of their respective barrels, and will be lowered into the water, being prevented from going down by the run by means of two small lines, the loop or eye at the end of each slipping from off the pin, when the turns of the lines have run off the barrels, and the boat, as before, will be free of its connection with the ship.

* The keeping a painter, at all times, rove, is not generally done in the merchant service, but it will be essential in a system the object of which is the speedy disengagement of the boats from the lowering apparatus.

The boat will now ride alongside in safety by means of the painter, and the slings and chains may be hauled into the boat; or, if the lashings of the slings be cut or let go, the slings and chains will sink into the water, clear of the boat.

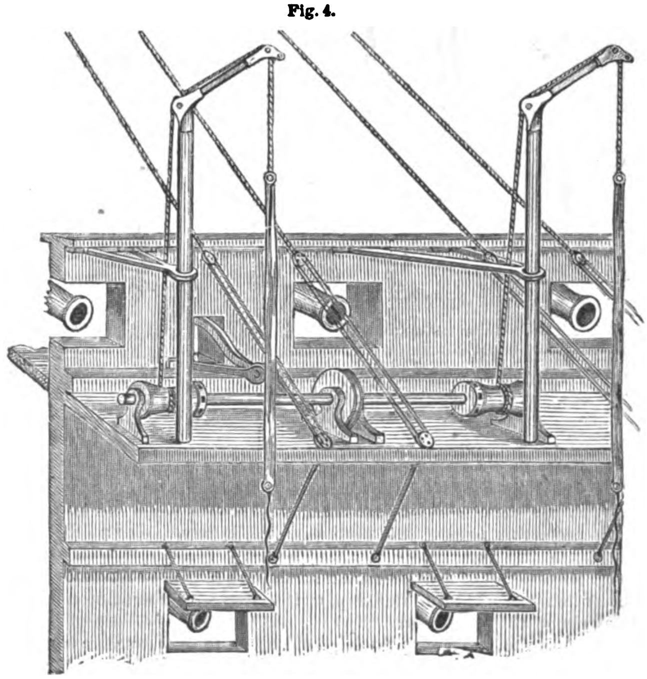
By suspending the boat in the manner thus described, with two stretchers to prevent the slings pressing in the gunwales, the straining of the boat at the tackles, a matter so much dreaded by the shipowner, is guarded against, the use of "chocks," "keel-cranes," and "crutches" is dispensed with, and the boat cannot, as is the case in lowering with the tackles, cant to one side or the other, but must go down into the water upon an even floor. By having the after-chain a few inches longer than the other, the boat would drop sufficiently by the stern (while hanging at the davits) to insure any water running out at the plug-hole, and moreover, in lowering, it would cause her stern to strike the water first.

In going into harbour or into dock, or in the event of ships coming in contact with ice, when it is necessary that the boats should be swung inboard, if slings have been passed from forward, aft, and *vice versa*, crossing under the bottom of the boat, the inner end of each sling being attached to the suspending chain, and the outer or unattached ends being secured to the suspending chains by a lashing, the boat may be swung inboard by the suspending chains.

As regards the boat's covers, which are only necessary in hot climates, but which, in the navy, are removed every night, and which, by the present system—being frequently lashed to the boat underneath!—must necessarily be an obstacle to the speedy "clearing away of the boats," they are intended to be laced above, from the stem to the stern, the gripes being passed over all. In cases of emergency, the cover, thus secured, might be lowered with the boat; and if the lacing be cut, even when the boat is in the water, the weight of the wet cover, being over and outside the slings, would cause it to sink clear of her.

In fine weather, or unless the ship is moving rapidly through the water, it is not intended to let go the ends of the suspending ropes or chains from on board; but immediately the boat reaches the water, the lashing of the slings will be slipped, and the boat will be clear, and the slings and chains are to be hove back into the ship. But in cases of emergency, the friction-strap being slackened, when the boat reaches the water, the suspending ropes and chains will pull away from the ship, and, with the slings, may be hauled into the boat; or, if the lashing be cut away, they will sink into the water, and the boat will be safe. The remaining illustrations show the practical application of the lowering apparatus to various parts of a ship.

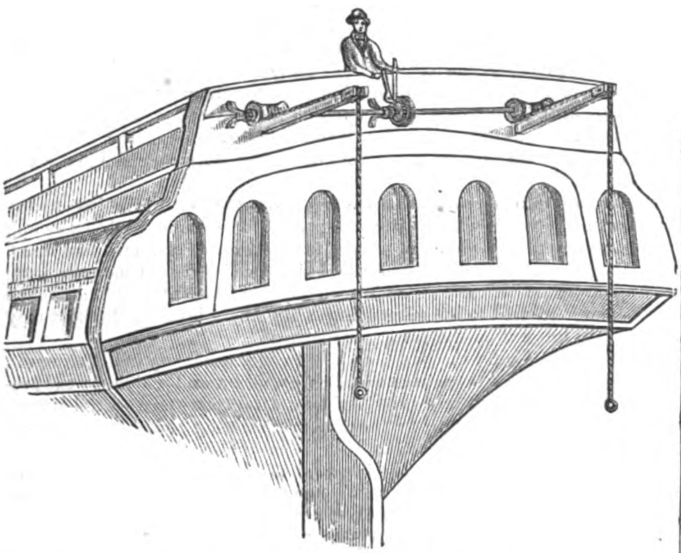
Fig. 4.



In fig. 4, the lowering apparatus, without the winch, is shown as fitted in the chains, outside the bulwarks, the shaft connecting the barrels running below the level of the ports, so as not to interfere with the direc-

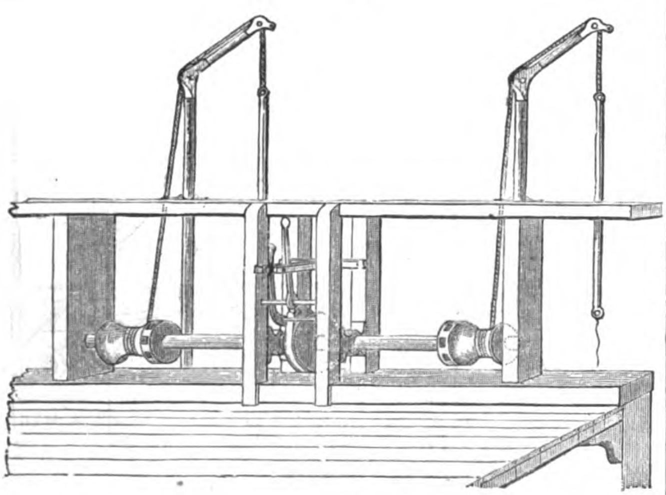
tion of the guns; and the levers of the friction-strap and pall being led inboard, at an equal distance between two guns, would not interfere with the working of the guns; or they may be fitted so as to be worked by a man in the chains outside.

Fig. 5



In fig. 5, the lowering apparatus is shown as fitted to the stern of a large steam-ship, the shaft that carries the barrels and friction pulley being mounted upon bracket bearings, secured to the timbers of the vessel. Immediately below the barrels project the davits, provided with sheeves, over which the suspending ropes or chains pass, the levers of the friction-strap and pall appearing above the level of the taffrail.

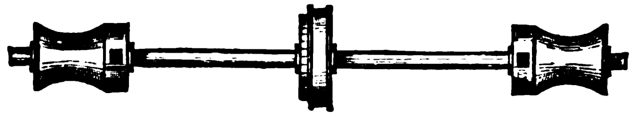
Fig. 6.



In fig. 6, the lowering apparatus is shown as occupying a position exactly in the centre of the bulwark, underneath the rail—none of the parts projecting beyond the timbers of the bulwark, except the friction pulley and strap, and that only a few inches. The object of this arrangement is economy of space—such a situation being least likely to obstruct the ordinary working of the ship, or interfere with the comfort and convenience of the passengers.

Fig. 7 is the shaft, with the friction pulley, ratchet, and the barrels. It will be seen, that in all these cases the levers of the friction-strap and pall are retained in their places by means of a bolt. If this bolt were locked by means of a master key, fitted to all the boats alike, and if one of these master keys were at all times worn, suspended by a ribbon or lanyard, by the captain, officers, and petty officers of the ship, no boat could be lowered without authority, the passengers would feel secure in the *existence of a safe system*, and the danger of a rush to the boats by an undisciplined crew, and a mass of panic-stricken passengers, would be avoided.

Fig. 7.



Mr. Lacon has just addressed an admirable letter on "The Management of Ships' Boats," with extracts from the evidence in the cases of the *Orion* and *Amazon*, to the President of the Board of Trade. To that very clear and copiously illustrated pamphlet, we may refer those of our readers who feel sufficiently interested in the subject, to crave more particulars than we can give in this place. The author's object is to attract the attention, and excite the interest of *sailors*, in the hope of making them feel that the lives of their fellow-men may be dependent on each of them.

Whilst we write, the report of the naval members of the Board of Trade, on the inquiry into the loss of the *Amazon*, has been laid before us. In making the following apt quotation from it, we more than ever feel it our duty to congratulate Mr. Lacon on his well-timed efforts:—

"The fatal consequences of this obstruction (the cranes) have been shown in the evidence, and we should hope the use of these cranes, or of any contrivance which obstructs the ready lowering of boats, may be forthwith discontinued.

"While upon the subject of the boats, we may advert to the lamentable loss of life which was occasioned by some of the boats being improperly lowered, and by the tackles not being readily unhooked.

"The means of lowering boats, and of readily disengaging the tackles, together with plugs which are self-acting, are desiderata wanting throughout the naval service."

REVIEW.

ON THE RAW MATERIALS FROM THE ANIMAL KINGDOM DISPLAYED IN THE GREAT EXHIBITION OF THE WORKS OF INDUSTRY OF ALL NATIONS. By RICHARD OWEN, F.R.S. Pp. 26. Bogue: London.

The idea which attaches to the term "raw materials," is as changeable as the uses to which raw materials are applied in manufacture; for it is obvious, that those destined for the loom or for the ironfounder hold a position comparatively below the textile fabric and the cast, which themselves become raw materials in the hands of the dressmaker, the builder, &c. Although, therefore, there may be a logical difficulty in the definition of the term in a purely scientific manner, this difficulty no longer exists when we employ it practically and in a popular sense. Hence, when we speak of raw materials, we refer, in common language, to those substances in the mineral, vegetable, and animal kingdoms, which come to us prepared only as nature has prepared them, whether by her ordinary processes, or by such as careful observation of the laws by which she herself is regulated, enables us to adopt in the laboratory. It has been found convenient, therefore, to separate, in their treatment, the three classes of raw materials as above enumerated. We have shown how Sir Henry de la Beche has touched upon those of the mineral kingdom, and we have now before us the observations of a no less distinguished individual on the raw materials from the animal kingdom.

Professor Owen, whose known devotion to the science of the organization of animals suggested to the Council the calling in to their assistance as a juror for Class IV. of "Vegetable and Animal substances used in manufactures as Implements or for Ornaments," was very properly selected as the person to whose care this labour was intrusted. And however comparatively remote from his more particular studies it may have been thus to descant on the results of the Exhibition as shown in the subject of the present discourse, we think the public must be amply satisfied, as the discourse itself will doubless add somewhat to the fame of its illustrious author. It is obvious that the art-manufacture relations of any subject rise in value and importance with the subject; and among the raw materials derived from the animal kingdom are many which, viewed in these relations, are not to be exceeded in interest by any others. A mere enumeration of the substances which Mr. Owen has thus treated is sufficient to show, without extending the category, how intimately they affect the well-being of humanity:—

Wool, hair and bristles, baleen, or, as it is commonly but improperly termed, whalebone—the substance bearing no reasonable comparison with bone—silk, feathers and down, horns and antlers, ivory, tortoise-shell, pearl, mother-of-pearl or nacre, cameo-shells, corals, gelatines, and isinglass.

Now, although very desirous that our readers should become more than ordinarily intimate with these remarkable lectures, we cannot devote so much space to them as we wish. Our best hope is, that what we may say will induce all who are anxious to *learn* something from the great lesson of the past memorable year, to obtain and diligently study the discourses (which, by the way, are published at a most reasonable price) *in extenso*. We shall therefore confine our attention to the learned professor's observations upon the great ancient staple of our country—wool, and the Eastern staple, silk.

Wool is defined as "a peculiar modification of hair, characterised by fine transverse or oblique lines, from 2,000 to 4,000 in the extent of an inch, indicative of a minutely imbricated scaly surface when viewed under the microscope, on which, and on its curved or twisted form, depends its remarkable felting property, and its consequent value in manufactures." Wool, we are informed, came to the Industrial Building from all parts of the world; from the provinces of Chinese Tartary, from Thibet, from India, in the east, to the lately redeemed tracts of the United States in the far west; from Iceland and Scandinavia in the north, to the Cape of Good Hope, Australia, and Tasmania, in the south; and from almost every intermediate latitude and longitude. It is not improbable that this truly cosmopolitan character of the sheep arises from both food and clothing being obtained, with the least trouble and skill, in all ages, from the same animal. And it is a striking fact, according to the present state of knowledge, that the sheep is not geologically more ancient than man. Upon the creature which thus appears to have been exclusively formed for man, he seems not ungratefully to have bestowed due care. The fine qualities of wool which have been produced are undoubtedly owing, as Mr. Owen observes, to the exercise of skill and tact in crossing and breeding from the best varieties. Other conditions are also involved, but this has been of the greatest importance. The facts mentioned in the following observations are singular:—

"Amongst the series of wools shown in the French department were specimens characterized by a well-skilled English expert as 'a wool of singular and peculiar properties; the hair glossy and silky, similar to mohair, retaining at the same time certain properties of the merino breed.' This wool was exhibited under No. 245, by J. L. Graux, of the farm of Mauchamp, Commune de Juvincourt (Aisne), as the produce of a peculiar variety of the merino breed of sheep. The following is a brief statement of this interesting case.

"In the year 1828, one of ewes of the flock of merinos in the farm of Mauchamp produced a male lamb, which, as it grew up, became remarkable for the long, smooth, straight, and silky character of the fibre of the wool, and for the smoothness of its horns: it was of small size, and presented certain defects in its conformation which have disappeared in its descendants. In 1829, M. Graux employed this ram with a view to obtain other rams having the same quality of wool. The produce of 1830 included only one ram and one ewe having the silky quality of the wool; that of 1831 produced four rams and one ewe with the fleece of that quality; in the year 1833, the rams with the silky variety of wool were sufficiently numerous of themselves to serve the whole flock. In each subsequent year the lambs have been of the two kinds; one preserving the characters of the ancient race, with the curled elastic wool, only a little longer and finer than in the ordinary merinos; the other resembling the rams of the new breed, some of which retained the large head, long neck, narrow chest, and long flanks of the abnormal progenitor, whilst others combined the ordinary and better formed body with the fine silky wool. M. Graux, profiting by this partial resumption of the normal type of the merino in certain of the descendants of the mal formed original variety, at length succeeded, by a judicious system of crossing and interbreeding, in obtaining a flock combining the long fine silky fleece with a smaller head, shorter neck, broader flanks, and more capacious chest. Of this breed the flocks have become sufficiently numerous to enable the proprietor to sell examples of the breed for exportation. The crossing of the Mauchamp variety with the ordinary merino has also produced a valuable quality of wool, known in France as the 'Mauchamp merino.' The fine silky wool of the pure Mauchamp breed is remarkable for its qualities as combing wool, owing to the strength as well as the length and fineness of the fibre. It is found of great value by the manufacturers of Cashmere shawls, being second only to the true Cashmere fleece in the fine flexible delicacy of the fabric, and of particular utility when combined with the Cashmere wool, in imparting to the manufacture qualities of strength and consistence in which the pure Cashmere is deficient.

"Although the quantity of the wool yielded by the Mauchamp variety is less than in the ordinary merinos, the higher price which it obtains in the French market (25 per cent. above the best merino wools), and the present value of the breed, have fully compensated M. Graux for the pains and care which he has manifested in the establishment of the variety."

The following instance of the singular care bestowed on these creatures is also interesting:—"Don Justo Hernandez had introduced into Spain the custom of clothing the sheep from the beginning of December to the end of May; and amongst the specimens transmitted to the Exhibition, was a fleece which had been so defended, and one that had been exposed to the direct influence of the atmospheric agencies. The difference in the quality was remarkable, and spoke decidedly in favour of the temporary protection of the fleece."

Where climate is added to these artificial modes of producing wool, and where the habits of the people are almost necessarily pastoral, as in our colony of New South Wales, we cannot be surprised when we are told that the small quantity of 245 lbs. of the substance first imported thence into England in 1807, should, in 1848, have amounted to 23,000,000 lbs., valued at more than £1,200,000 sterling.

Silk is defined as "a secretion of a pair of long glandular tubes, called *sericteria*, which terminate in a prominent pore or spinnaret on the under lip. Before their termination they receive the secretion of a smaller gland, which serves to glue together the two fine filaments from the 'sericteria,' the apparently single thread being in reality double, and its quality being affected by the equality or otherwise of the secreting power of the 'sericteria.'" The following details exhibit the care which has been bestowed upon the culture, if we may so speak, of this delicate and beautiful material:—

"The main object of the silkworm breeder is to obtain cocoons of a large size, composed of a long, strong, very fine, even, and lustrous thread. These properties of the silk were found realized in the highest degree in the specimens transmitted from France, in which country the development of the silkworm has for a long period exercised the care and pains of many able silkworm breeders, and of late years has been the object of systematic advancement by the Central Society of Sericiculture of France.

"The *Bombyx mori*, having been bred and reared under the special care and management of man during a long succession of ages, may be regarded as a domesticated species of insect; and it has become the subject, as in the higher domesticated races, of varieties, of which those called 'Sina,' 'Syrie,' and 'Novi,' in France, are examples.

"The Sina variety of the silkworm is known and esteemed for the pure whiteness of its silk, the thread of which is fine, but weak, and not very lustrous. The Syrie variety is of large size, produces a cocoon abundant in silk, but the thread is rather coarse, and inclines to a greenish tint. The Novi race is small, but the cocoons are firm and well made, and the silk has a yellowish tint.

"The Jury justly gave the honour of their first notice to the specimens shown under No. 782, by Major Count de Bronno Bronski, exhibitor of unbleached silk and silk cocoons from the Chateau de St. Selves, near Bordeaux, Department de la Gironde. The cocoons were remarkable for their large size and regularity of form, and the silk for the unusual length of the thread, its natural pure white colour, its fineness and lustre. The circumstances under which this superior quality of silk was obtained are certified in a report by a Committee of the Agricultural Society of the Gironde, dated 28th April, 1847, to be as follows:—'In 1836, Major Bronski reared separately the eggs of the three varieties, Sina, Syrie, and Novi. In 1837 he set apart the cocoons of the varieties Syrie and Novi; and on the exclusion of the imago, or perfect insect, he associated the males of the Novi with the females of the Syrie; and the hybrid ova were hatched at the ordinary period in 1838, the operations being repeated in 1839 and 1840. With regard to the race Sina, M. Bronski, in 1837, separated the white from the black worms as soon as they were hatched. He then selected the largest and best-shaped cocoons, and made a special collection of the eggs from the moths excluded from those cocoons. This procedure was repeated in 1838 and 1839; but in 1840 he associated the males excluded from the large cocoons of the black worms with the females excluded from those of the white worms. In 1841 he associated the males of the Sina race with the hybrid females obtained from the above-described crossings of Novi and Syrie breeds.' By these and similar experiments M. Bronski at length appears to have succeeded in obtaining a race of silkworms not subject to disease, producing large and equal-sized cocoons of a pure white colour, the silk of which was equal in all its length, strong and lustrous, and presenting an average length of thread of 1057 metres."

No doubt "mankind owes more to the powers and operations of nature than to the inventions and appliances of art" for all raw materials, in the sense in which we have used the term. But we are bidden by all observation to be assured, that "almost every vegetable or animal substance may be modified, and, in its relations to utility to man, improved by a change of the circumstances under which it is naturally developed; such change or improvement being suggested by a patient study of the respective influence of those circumstances upon the useful properties of the substance." It is this reflection which must urge us on in the pursuit of all means to attain the object in view. How much of the improvement which has already taken place is due to the mechanic! How much more urgently is he at present called upon to exert his strength of labour and ingenuity to enable us to retain in England *that* place which the results of the Great Exhibition show that we have not *yet* lost, by further improving the delicacy of manipulation of those iron fingers which have added so much to the power of man.

We had purposed to notice some reasons which Mr. Owen tells us operated with the Jury in those judgments, against which the voice of censure has been heard louder than that of praise. But we reserve the remarks for another opportunity. We cannot, however, refrain from extracting the concluding paragraph of the professor's discourse, in the sentiments of which our readers will, we know, heartily join.

"Whatever the animal kingdom can afford for our food or clothing, for our tools, weapons, or ornaments—whatever the lower creation can contribute to our wants, our comforts, our passions, or our pride, that we sternly exact and take at all cost to the producers. No creature is too bulky or formidable for man's destructive

energies; none too minute and insignificant for his keen detection and skill of capture. It was ordained from the beginning that we should be the masters and subduers of all inferior animals. Let us remember, however, that we ourselves, like the creatures we slay, subjugate, and modify, are the results of the same Almighty creative will; temporary sojourners here, and co-tenants with the worm and the whale of one small planet. In the exercise, therefore, of those superior powers that have been intrusted to us, let us ever bear in mind that our responsibilities are heightened in proportion."

CORRESPONDENCE.

THE ELEVATION SIGHT FOR RIFLES.

The increased range and accuracy obtained with rifles by the use of elongated and conical balls, renders it more than ever necessary to improve the elevation sight, at present in use, both in principle and construction.

The greater the range, the greater the necessity for delicacy of aim with respect to elevation. Every rifle-shooter knows that it is the horizontal line which it is so difficult to strike, when beyond the point-blank distance. It is easy to pitch a ball a *little over*, or a *little short* of a duck on the water, at two hundred yards; but to *go slick into* him, requires a nicety of aim, with regard to elevation, not so easy to attain. In the shop windows of London, there may still be seen rifles which are sighted in the barbarous manner of twenty years ago. A silver button from a page's jacket is placed upon the muzzle, and a barn door upon the breech. The barn door is, to be sure, a little open, nearly from top to bottom, but it is not sufficiently open to see through, and much too open to afford a centre, which I suppose it is intended to do. Such sighting is only calculated to mislead. It would appear to be a simple enough reason to give to most people, that the mere obstruction offered to the clear view of an object in shooting, was a sufficient objection to the solid plate elevation; and that—even when only a very slight angular notch is cut for the centre, as now done by the best gunmakers. But it is, I think, wrong in principle, to place anything upon the barrel as an elevation sight, which obstructs the view, or covers too large a portion of the retina of the eye. It is wrong, for reasons which are derived rather from the physiology of the brain than from anything in mechanical gunnery. When a large portion of the retina of the eye is covered by a *near object*, the sensibility of the remaining portion to the weaker impression of a *distant mark* is considerably diminished; though powerful contrast causes some exception to the rule. There is also a tendency to fix the axis of visual rays upon the *nearer* body, in which case the distance becomes wholly invisible as to detail.

In all quick muscular motions, governed by impressions on the eye, the muscular movement is directed and controlled by the *strongest impression*. It is easy to put out the right hand, and to seize and detain a cricket ball, moving across at the rate of forty miles an hour; but if the cricket ball was coloured grey, and was accompanied in its flight by another, two or three inches above or below—painted black, and larger in size—the hand would instinctively seize the latter. It would require, with natural skill and practice, a powerful effort not to do so; and in all quick movements, when there is effort, there is constant failure. There is no shooter, however skilled, who has not occasionally felt the tendency to withdraw the eyes from the mark to the barrel of his gun, at the moment of firing, and this more frequently in rifle shooting, with an elevation raised. Though shooting, like everything else commonly styled mechanical skill, depends essentially upon particular brains, and a healthy state of the nervous system, yet there is a rule which is of service to all, and the truth and value of which all shooters are ready to acknowledge, viz.:—"Let the eyes be full upon the mark at the moment the trigger is pulled, and as the shot or ball leaves the muzzle of the gun;" and I would urge the rule still farther by saying, "See the shot or ball go into the bird, or beast."

Whatever cause renders it difficult to observe this rule, is also a cause of bad and uncertain shooting. Independent of all those causes, to which are applied the term nervous, I believe that the tendency to withdraw the eye from the mark is very much increased, even among picked shots, by the obstruction, and strong impression on the eye, of the solid elevation; and to beginners, and those having a natural inaptitude for such things, it is a still greater impediment. Again, whilst in shooting, the eye is to be firmly fixed upon the mark, it does not follow that the barrel of the gun is not to be seen at all; on the contrary, it is of equal importance that the eye should have cognisance of the barrel, although the axis of vision is not directed to it. The solid plate elevation conceals the whole of the barrel beyond it from the eye, and the latter is wholly dependent for perceiving the true direction of the muzzle, by the muzzle sight, and the very slight assistance which is given in this respect by the left eye; this again is another powerful cause tending to bring back the axis of vision to the gun, as before said of the strong impression of the elevation. The majority of shooters have never acquired, and never will acquire, the power of using both eyes in shooting. They at least would be benefited by enabling them to see what they are shooting at.

It is difficult to prevent the edge of an elevation plate from becoming bright, or polished, and, consequently, in sunshine, or even in open daylight, the edge is obscured by an irregular radiance, not affording a clearly defined line, which latter is essential for delicacy of aim with respect to elevation. If a rifle now will range with execution up to a thousand yards, it is indispensable, if we are to make proper use of this advantage, to be able to adjust a single sight to a variety of distances with nicety; and also to contrive it so, that it will close down flat upon the barrel, leaving nothing to appear above, or prevent the ready use of the gun for quick shooting at near and moving objects. I think both practised shots and beginners will feel the advantages of an elevation sight, on the principle described and figured in another part of this *Journal*. A model is to be seen at Mr. Lancaster's, in Bond Street, who will make them for guns of any size. The scale of elevation, which is marked to suit from 100 yards to 600 or 1000, is obtained, in the first instance, for a single piece, by careful trial before the target; but it would not be necessary to go through this process with a thousand guns of the same length, weight, and calibre, and carrying the same ball and charge of powder. The distance of the elevation from the muzzle should exactly correspond in all.

I tried an elevation on this principle, more simple in construction, with the first rifle I ever used, nearly twenty years ago. There was something so palpably wrong to my feeling, in the barn door and page's button before alluded to, of the rifles of that day, that I knocked off both with a hammer, before I had tried a score of shots. I first substituted a fragment of a broken needle, fixed in a slide of lead, for the muzzle sight, which contrivance I found much better adapted for picking out the tender parts of a crocodile, than the blazing orb which I had removed, and which, under a tropical sun, appeared to me always much wider than the crocodile was long. For practical shooting, up to 150 yards, no elevation at all appeared to be the best. As I increased in distances, I used a slip of wood carrying arms of tin-plate, with a needle run through near the top, which is the instrument I have described above in its simplest form. I never notched the centre of the needle, for I found that the eye can divide a short line, placed between two perpendiculars, more accurately than the compasses, and as far as 400 yards. I have never been able to obtain better results since, or to contrive a better form of elevation, further than to render it adjustable to fixed ranges, and lately to put it into a neat and serviceable shape. The advantages are, that the eye is sufficiently guided by a fine line, but not diverted by it. A small and distant mark is wholly and distinctly visible to the right eye, (which alone* deals with the perpendicular or vertical line in shooting,) without effort or straining, which is not always the case with the most practised shot, in particular lights, with a solid plate. The muzzle of the gun is opened to view, and its true position felt by the eye, without receiving undue attention from the latter; that is, again, without drawing the axis of vision from the mark. The needle being cylindrical, however fine, and in whatever direction the light may be, it will always have a shadow as well as a light; both of which will be in a *straight line*; and even when polished, will afford a finer and more clearly defined line, than the edge of a solid plate can ever do, under the open sky. A fine but distinct *line*, truly horizontal, is what alone is required for an elevation, and a thin clear glass plate having fine lines cut into it (a horizontal line and a perpendicular meeting it from below), and blackened by paint rubbed into them, forms a sight even more delicate as to line, in all lights, than the one I have described. It is not to be despised for temporary use; but a glass plate is liable to be scratched or broken, and to be obscured by wet or dust.

HENRY MALING.

Home Office, March, 1852.

MENISCUS LENSES FOR THE PHOTOGRAPHIC CAMERA.

Seeing that you occasionally notice the progress of photographic improvement, and being myself practically interested in the art, I should be glad of your assistance on some points of doubt.

A writer on this subject, Mr. G. S. Cundell, quotes Dr. Wollaston to the effect, that "a lense of the meniscus figure, *under certain conditions*, will give a picture, which, although not absolutely flat, is much more so

* I mean that the right eye places the axis of the barrel in a vertical plane, in which lies the mark. In whatever the right eye does, it is *assisted* by the left.

than can be produced by any other means." Now, this appears to me to show that the meniscus lens is superior to the achromatic for photographic purposes. I should therefore be glad to know—

1st. If, by having the first lens of 12 inches focus, and the other of 6 inches, they would act as well as two of 9 inches focus.

2d. What proportions the concave and convex surfaces should bear to each other, and how far apart they ought to be.

3d. If the meniscus is found in practice to be better than the achromatic lens for the production of photographs.

4th. If my idea is wrong, what is the best arrangement? My idea is to use the combined arrangement for portraits, which require quick action; then, by taking the two lenses singly, two other foci, of 5 and 12 inches, can be obtained in one camera and set of lenses.

I intend to execute the wood and brass work of the apparatus myself, and mean to use lenses 3 inches diameter.

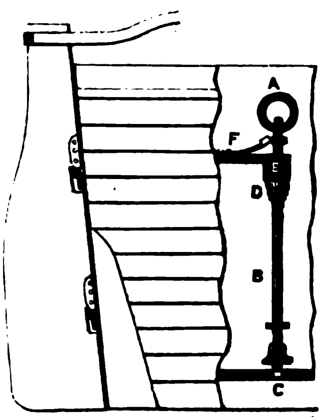
J. B.

Cumnock, March, 1852.

SAFETY BOAT-PLUG.

As your pages of last month treat of boat-plugs, it has occurred to me to lay before you a sketch of a simple self-acting plug, which I shall be glad to see in your pages.

The figure represents the stern of a boat, with a portion of the side broken away to show the valve inside. The suspension ring, A, to which the hoisting blocks are attached, carries a sliding rod, B, passing through a second guide to the bottom of the boat. The lower end of this rod carries a metal disc, faced with india-rubber, to form a valve to cover the aperture, C. The rod has also a flat helical spring, D, bearing against the under side of the cross-beam, E, and acting downwards, so as to tend to retain the valve down on its seat. Thus, when the boat is suspended from the davits, the spring is compressed by the boat's weight, and hence the valve is opened, as shown in the sketch; but when the boat is lowered, the reaction of the spring at once closes the valve, as the weight is taken off by the seating of the boat on the water. To guard against mismanagement between the points of suspension and flotation, it would be as well to have a flap of india-rubber on the outside of the boat. Also, when resting on chocks, it would require a spring detent, F, to keep the valve open. This I think would be the only inconvenience attending the arrangement.



J. G. Winton.

Glasgow, March, 1852.

[We should have considerable hesitation in connecting the plug—which must be delicately treated—with the suspension apparatus, so liable to rude shocks. Our correspondent seems to forget that water would make its way into the boat during whatever time elapses between the touching of the water, and the reaction of the spring. This proposal of an external flap valve, to be sure, provides for this, but then this practically involves two sets of valves. The external flap has been often proposed, but we do not think it is to be trusted. Mr. Ower of Dundee is the inventor of a valve, acting on a similar principle, which he explained to us so far back as the beginning of 1851.*—Ed. P. M. Journal.]

LOADING MACHINE FOR CARTS.

In Havre, I have observed that the carts employed about the docks are each furnished with a winch, which enables the carter to load and unload with great facility. The cart has two wheels, and the body is capable of turning on the axle as a centre, so that the hinder end of the cart may rest on the ground, and form an inclined plane. On the front of the cart there is fixed an axle, having a barrel or roller, on which a rope is wound, and on the ends of which bars are shipped like capstan bars. The shafts to which the horse is yoked are not connected with the body of the cart, but with the axle, so that the tilting of the cart does not incommode the horse.

In loading the cart, the body of it is tilted so that the after-part rests on the ground; one or more ropes are then passed from the axle round the goods to be lifted, and the capstan handles are worked, whereby the goods are dragged upon the cart. In unloading, the tail of the cart falls to the ground, and the cart being withdrawn, the whole load—often three tiers deep of boxes of silk goods—is easily and gently deposited on the quay. This description of cart is by no means expensive; and I think we might do worse than adopt it, as we have already adopted another Havre invention—the mode of lighting the Gorbals clock.

Havrais.

Glasgow, March, 1852.

SUBSTITUTE FOR THE AIR-PUMP IN MINING ENGINES.

If "Novice" is not a very old man, the plan he mentions for producing a vacuum in our Cornish engines was tried in Cornwall before he was born. It will not do, because it will not extract the air, from which the best condensing engines are not exempt. There must be a pump for this purpose; and hence the name given to the air-pump of steam-engines.

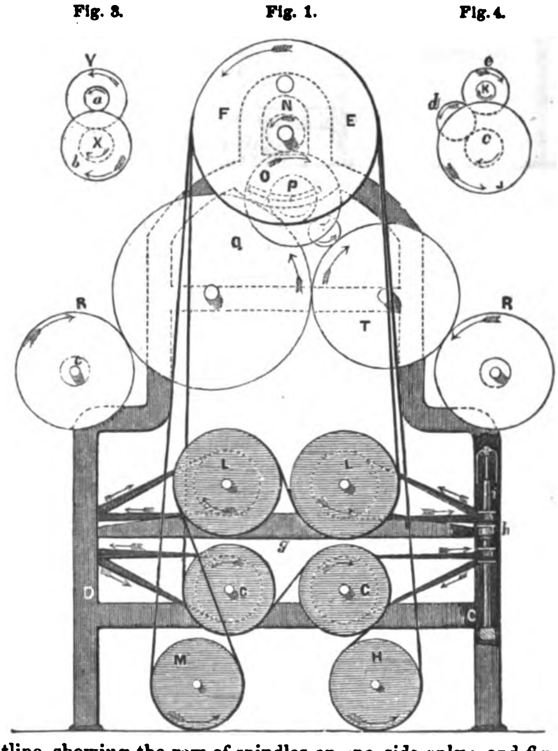
March, 1852. A Cornish Engineer.

[Mr. Ellis, of the Tredegar Ironworks, has also informed us that he proposed the plan, and made drawings of it, for adoption in one of Trevithick's old high-pressure engines, as early as 1836, his father having thought of it even as early as 1825. The publication of "Novice's" note has thus confirmed us on the two points which we had in view, in making known his proposition—the doubt as to novelty, and the insuperable difficulty of the air.—Ed. P. M. Journal.]

DEMPSTER'S SELF-REGULATING SPINNING-FRAME.

This spinning-frame, which I arranged as far back as 1844, is proposed as capable of affording more yarn per spindle, in a given time, with less waste, and requiring less attention from the attendant than the common frame. Fig. 1 of the sketches is an end elevation of the machine

Fig. 3. Fig. 1. Fig. 4.



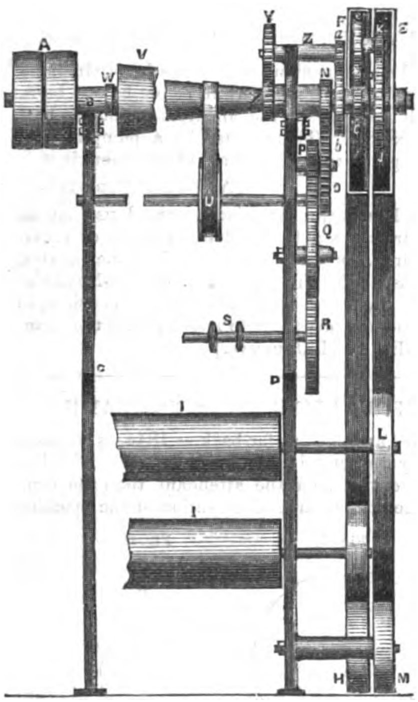
in outline, showing the row of spindles on one side only; and fig. 2 is a front view of the movements, partly in section. Fig. 3 is a diagram of the wheels used for getting up the speed of the cone; and fig. 4 is a diagram of the differential box-gearing.

The frame is actuated by the fast and loose pulleys, A, on one end of the main longitudinal shaft, B, which extends along the entire length of

* See page 287, Vol. III., *ante*.

the frame, between the two end standards, C, D, the parts between which are broken away in fig. 2, to avoid repetition and complexity. The opposite end of this shaft carries the pair of differential pulleys, E, F, shown in section in fig. 2, to exhibit their internal wheels. From the inner pulley, F, fast on the shaft, an endless belt passes to the two pulleys, G, beneath, returning round the guide-pulley, H, thus actuating the two cylinders, I, for driving the two lines of spindles. The other differential pulley, E, is loose on the shaft, and is carried round with the pulley, F, through the intervention of the wheel, J, in gear with the pinion, K; the wheel, J, being fast on the boss of the pulley, E, whilst the pinion, K, is fast on its stud-pin, running in the arm of the pulley, F. The pulley, E, has also a belt, passing to the two pulleys, L, for driving the bobbins, and returning by the guide-pulley, M.

Fig. 2.



The drawing rollers are driven from the pinion, N, in gear with the wheel, O, on the boss of which is placed the shifting twist-pinion, P, gearing with the large carrier-wheel, Q, which again gears with the wheel, R, fast on the spindle of the drawing-roller, S. The other side of the wheel, Q, gears with the wheel, T, driving the opposite drawing roller, as well as the pinion, T′, fast on the end of the shaft of the slide or transverse pulley, U, which has an endless belt for actuating the cone-pulley, V. The large end of this cone, which is loose on the driving-shaft, carries a pinion, W, for driving the traverse apparatus. Its opposite end carries a pinion, X, gearing with the wheel, Y, fast on a short spindle supported in the socket, Z, and carrying at its opposite end a pinion, *a*, in gear with the wheel, *b*, loose on the main shaft, B. The wheel, *b*, has a pinion, *c*, fast on its boss, and gearing with the carrier-wheel, *d*, the stud of which is fast in the arm of the pulley, F. This carrier gears with the wheel, *e*, fast on its stud-pin, which passes through the socket, *f*, this socket being part of the arm of the pulley, F. It is the opposite end of this stud-pin which carries the pinion, K, already referred to. The rail, *g*, fig. 1, has its ends fast to the traversing rails, and on these rails are fixed the brackets for carrying the two cylinders driving the bobbins, and consequently these cylinders will traverse along with the bobbins. The end junction of the rail, *g*, with the traverse rail, is shown at *h*, which is a section of the traverse-rail end. The neck-bearing for the spindle, *i*, is fast in the traversing rail, and is secured by a nut on the lower side of the rail. The bearing, *i*, of the spindle is continued up the spindle as far as the top of the bobbin; and I would propose that this socket should be bored out about $\frac{1}{16}$ of an inch wider than the diameter of the spindle, this $\frac{1}{16}$ to be filled up by a bush of sheet-brass; so that, when looseness arises from wear, all that is necessary is to re-bush the socket. The value of the traversing neck-bearing is well enough known without any elucidation from me. I have only to state, that, by its use, I shall be enabled to drive the spindles much quicker than by the usual plan. The warve, *j*, for driving the bobbin, is carried upon the socket, *i*, the bobbin resting on its upper end, and being carried round by means of pins to connect the two. The spindle foot-rail is the same as the common one.

GENERAL DIMENSIONS.

The pitch of the wheels is expressed by the number of teeth, corresponding to one inch diameter.

Driving-pulleys, A, 12 inches diameter, by 4 inches broad; cone, V, 9 inches at large end, and 3 inches at small end—length not less than 36 inches; differential pulleys, E, F, 24 inches by 3 inches; pulleys, L, for driving bobbin-cylinders, 14 inches by 3 inches; warves, 1¼ inches; pulleys, G, for driving spindles, 12 inches by 3 inches; the four cylinders, I, for driving the spindle actions, 9 inches diameter.

Pinion N,	40 Teeth,		No. 8 Pitch.
Wheel O,	100 "		"
Shifting twist-pinion P,	60 "		"
Carrier-wheel Q,	206 "		"
Wheel T,	150 "		"
Wheels R,	120 "		"
Pinion T,	35 "		"

DIFFERENTIAL BOX.

Wheel I,	75 Teeth,		No. 6 Pitch.
Pinion K,	15 "		"
Wheel *e*,	36 "		"
Wheel *d*,	30 "		"
Pinion *c*,	30 "		"

CONE MOTION.

Wheel *b*,	72 Teeth,		No. 8 Pitch.
Pinion *a*,	24 "		"
Wheel Y,	60 "		"
Pinion X,	36 "		"

Sliding-pulley V, ... 9 inches diameter.
Drawing-rollers, ... 3½ "

CALCULATIONS OF SPEEDS.

In laying out this machine, I directed my attention essentially to get the speed of the main shaft to coincide with that of the cylinders of the old frames, so as to avoid the necessity of driving the mill shafting quicker, or making the drums larger. In connecting the cone with the differential box, I have bestowed much attention to the determination of the best velocity. It appears to me that the belt upon the cone, aided by a reduced motion, must be able to resist the whole strain on the pulley, E, without the least slip. Then the diameter of the pulley, E, multiplied by its velocity and by its breadth of belt, must be equal to the diameter of any part of the cone, multiplied by its velocity at that part with its breadth of belt.

Hence for the pulley, E, we have motion, 1 inch; diameter, 24 inches; and belt, 3 inches. Therefore, $1 \times 24 \times 3 = 72$, the known produce of the pulley, E; and in order that there may be room for the shaft, B, to pass through the small end of the cone, it cannot be less in diameter than 3 inches, and about 1·6 inches may be reckoned a convenient breadth for the cone-belt, the half of which may be fixed upon as safe in the calculation. Therefore, it only remains now to find how many times the motion must be reduced from the cone, V, to the pulley, E. And, taking half the breadth of the cone-belt, we shall have $\frac{1 \cdot 6}{2} = \cdot 8 \times 3 = 2 \cdot 4$, and the product of the pulley, E, we have the required velocity; that is, $72 \times 2 \cdot 4 = 30$ times that the motion must be reduced between the cone, V, and the pulley, E, in order to insure the holding of the belt upon the cone.

DIFFERENTIAL BOX.

Let us suppose, in the first place, that the pulley, E, is turned once round, and the shaft, B, standing, then, by tracing the wheels and pinions in the ordinary way, we shall have $\frac{1 \times 75 \times 36 = 2700}{15 \times 30 = 450} = 6$ turns of the pinion, *c*, for one turn of the pulley, E; and this may be proved to be the same as if the pinion, *c*, were to stand, and the shaft, B, to revolve 6 times round its own axis, carrying the pulley, F, along with it; in which case the differential box will have revolved 6 times round the pinion, *c*, which is the same as if the pinion, *c*, had revolved 6 times round its own axis, plus or minus the revolutions of the shaft, B; or it will have either caused the pulley, E, to gain or lose one revolution for every 6 revolutions of the shaft and pulley, F; that is, the pulley, E, will either give 5 or 7 revolutions for every 6 revolutions of the pulley, F.

BOBBIN AND SPINDLE MOTION.

Considering the cone or taking-up motion standing: Here it is absolutely necessary that the motion of the bobbins and spindles should be as exactly the same as they can be made, considering the cone at rest. This we shall accomplish upon the diameter of the pulleys, L; and to find their diameter, we have for our data 6 revolutions of F for 7 of E; therefore, the pulleys, G, must be to L as 6 : 7 :: 12 : 14 inches diameter of L, 12 being the diameter of G; and this is supposing all the other elements in the two combinations to be the same.

TRACING OF THE SPINDLES' MOTION.

Supposing the shaft, A, to revolve 600 times per minute, which is about the motion of the cylinders in the common frame; therefore, $\frac{600 \times 24 \times 9}{12 \times 1{\cdot}5} = \frac{129600}{18} = 7200$ revolutions of the spindles per minute.

BOBBIN MOTION.

Here the motion of the pulley, E, will be as 6 to 7; therefore, 6 : 7 :: 600 : 700 revolutions of E per minute in this case. Then $\frac{700 \times 24 \times 9}{14 \times 1{\cdot}5} = \frac{151200}{21} = 7200$ revolutions of the bobbins also per minute, when the cone is standing. This high velocity for the spindles has been presumed, in consequence of the application of the traversing socket-bearing for the spindles.

DRAWING ROLLER.

To find the motion of the drawing roller, we have:—

$$\frac{600 \times 40 \times 50}{100 \times 120} = \frac{1200}{12} = 100$$

revolutions of the roller per minute, with a twist-pinion of 50 teeth.

Again, its circumference is nearly 11 inches, and $11 \times 100 = 1100$ inches delivered per minute; and supposing the frame to work 11 hours each day, it would throw off $1100 \times 60 \times 11 = 726000$ inches per day per spindle. And $\frac{726000}{36} = 20166{\cdot}6'$ yards per day, and $\frac{20166{\cdot}6'}{14400} = 1{\cdot}4$ spindles of yarn per spindle each day; or $20166{\cdot}6' \div 300 = 67{\cdot}2$ leas per day; and according to the motion of the spindles and drawing roller, as at present calculated, the yarn would get $6{\cdot}5'4'$ twists per inch; but the drawing roller can have any required motion by shifting the pinion, P, as in the existing spinning-frames.

LAPPING-MOTION OF THE BOBBINS.

It is plain that if the spindles and bobbins run at the same uniform rate when the cone stands, the latter has only to cause the bobbins to lap, or take up the yarn as fast as the drawing roller delivers it. Then the cone has to make the bobbins either gain or lose upon the spindles, the losing principle being very obviously the most advantageous. We must bear in mind that the cone action is quite a distinct element; and in order to get a clear comprehension of it, we may suppose the bobbins and spindles to be at rest as regards the uniform motion of the bobbins and spindles, which is only necessary for effecting the twist—all the other elements being in motion; then it is to be seen that the yarn will be wound upon the bobbins, but without twist; and if the diameter of the part on which the yarn is wound were always the same, no cone nor any differential motion would be required. But as every layer of yarn on the bobbins makes them larger, the motion of the cone must be varied in the same proportion.

EQUATION OF THE DRAWING ROLLER AND THE BOBBIN SHANK.

The diameter of the drawing roller, multiplied by its motion, is equal to the diameter of the bobbin shank, multiplied by its motion in the same unit of time; and having any three of these given, the fourth may be found.

Then, to find the revolutions of the bobbin, supposing its shank to be one inch, we have $\frac{3\frac{1}{2} \times 100}{1} = \frac{350}{1} = 350$ revolutions that the bobbin must be made to lose upon the spindles when empty, that is $7200 - 350 = 6850$ revolutions that the bobbins would actually have when empty.

In joining the motion of the spur-pinion, N, on the main shaft, with the lapping motion of the bobbins when empty, and the belt on the small end of the cone, circumstances have already determined the dimensions of all the elements, except the diameter of the slide pulley, U. To find its diameter we have the following:—

$$\begin{array}{l}
\text{A,} \ldots\ldots \; 7 \quad 1 \quad 7 \quad 1 \quad 1 \quad 1 \quad 1 \quad 1 \quad 35 \quad 1 \\
\dfrac{350 \times 15 \times 14 \times 75 \times 36 \times 72 \times 60 \times 3 \times 35 \times 100}{9 \times 24 \times 15 \times 30 \times 24 \times 36 \times 0 \times 50 \times 40 \times 600} \\
\text{B,} \ldots\ldots \quad 1 \quad 8 \quad 1 \quad 1 \quad 1 \quad 1 \quad\quad 1 \quad 8 \quad 3
\end{array}$$

These elements being cancelled, they are as under:—

$$\begin{array}{l} \text{Product of the line A,} \\ \text{Do. do. B,} \end{array} \frac{1715}{192} = 8{\cdot}93229 \text{ inches,}$$

or very nearly 9 inches, the diameter of the slide pulley, U.

SLIDE SHAFT PINION, T.

This pinion may be changed to suit the diameter of the bobbin shank, and is in direct proportion to the diameter thereof. Thus, 1 inch shank requires a pinion of 35 teeth, what pinion will be required for a shank 1·2 inch diameter?

Here we must first consider whether the pinion is a driver or is driven. If it were a driver—then, as the bobbin shank is larger, it would require to have fewer teeth, and *vice versa*. Here, however, it is driven, and therefore, as 1 : 1·2 :: 35 : 42 teeth, that the pinion, T, would require, to answer 1·2 inch bobbin shank.

The traverse apparatus is not figured in the drawings, as there is no novelty in it; but it may be supposed that the common heart-action is used, with the difference, however, that instead of the retaining rollers driving the hearts, there is a shaft running from the standard, D, to the outside one, to carry the hearts. This shaft has a wheel fixed on its inner end, gearing with the pinion, W, on the cone. Again, on the outer end of this shaft is a pinion, giving motion to the two hearts; this pinion to be called the shifting traversing pinion, for changing to suit any count of yarn.

As a fundamental element in calculating the size of pinion for altering the traverse, and the rack for shifting the belt on the cone, it is to be remembered that a thread, from the system of its formation, is, in mathematical language, a *cylinder*, and we know that the weights of cylinders are to each other as their solidities, and as the squares of their diameters. Therefore, although we cannot measure the diameter of a thread, we can weigh it, which comes to the same thing. Yarn four times the weight of another kind, will only have twice its diameter; that is, yarn of 48 ounces per spindle will only be twice the diameter of yarn of 12 ounces per spindle. Thus the traverse pinion must be in proportion to the diameter of the yarn, or as the square root of its weight. Then we have:—As the square root of the given weight of yarn is to the teeth in the pinion used for it, so is the square root of the required weight of yarn to the pinion used for it. Thus, $\sqrt{48} = 6{\cdot}928$, and $\sqrt{12} = 3{\cdot}464$: then, 6·928 : 3·464 :: 42 : 21 teeth in a pinion for lapping 12 ounce yarn, supposing that 48 ounce yarn required a pinion of 42 teeth.

The rack is, in its nature, the same as a pinion, with this difference, that whatever number of teeth it may have, the bobbin will just have as many concentric layers; but as the bobbin must always have the same diameter when full, and the belt upon the cone must always travel the same distance along the cone, therefore the teeth in the rack must be varied to suit the different sizes of yarn, and the finer the yarn the more teeth in the rack. The rule, then, for finding the number of teeth in the rack will stand thus:—As the square root of the required weight of yarn is to the square root of the given weight, so is the given rack to the required rack. Thus, suppose a rack of 72 teeth to be fit for 12 ounce yarn, what is the number of teeth to suit 48 ounce yarn? Here $\sqrt{48}$: $\sqrt{12}$ :: 72 : 36 teeth in a rack fitted for 48 ounce yarn.

It may be observed, that there exists a curious sympathy between the traverse pinion and the rack, and that is, the teeth in the rack multiplied by the teeth of the corresponding traverse pinion, will produce a constant number. Thus, a rack fit for 12 ounce yarn has 72 teeth, and its corresponding pinion has 21 teeth, and $21 \times 72 = 1512$. Again, a rack fit for 48 ounce yarn has 36 teeth, and its corresponding pinion has 42 teeth, and $42 \times 36 = 1512$, the same as before; and this property in the rack and pinion enables us to simplify the preceding rules, as the following example will show;—for having found, by the given rule, the number of teeth the rack should have, we may then divide the constant number by the number of teeth found for the rack, and the quotient will be the corresponding traverse pinion. Thus, having found by the preceding rule that 36 teeth in the rack is fit for 48 ounce yarn, we have only to proceed thus: $1512 \div 36 = 42$ teeth, as before.

In stating the advantages of this plan of machine, it is to be remarked that the cone motion is capable of easy adjustment to cause the bobbins to take up the yarn exactly as the drawing rollers deliver it; and moreover, it may be caused to wind the yarn on the bobbins with any required degree of tension. Thus, if the take-up were too great, and the material bad, to prevent breakage the attendant has only to alter the tempering-rod, regulating the sliding pulley, to remedy the evil at once, whilst the machine is in motion. No drag weights are necessary.

It is also possible to have double the number of bosses on the rollers in the same space, as well as two rows of spindles on each side of the frame.

R. DEMPSTER.

March, 1852.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INSTITUTION OF CIVIL ENGINEERS.

February 17 and 24, 1852.

The discussion on Mr. W. B. Adams' paper, "On the Permanent Way of Railways," occupied the whole of these evenings.

March 2.

"On the Electric Telegraph, and the principal Improvements in its Construction," by Mr. F. R. Window.

March 9 and 16.

"Discussion on Mr. Window's paper."

ROYAL INSTITUTION.

Friday Evening, January 30, 1852.

Mr. Hamilton in the Chair.

"On Electro-magnetic Clocks," by Professor Brande.

He observed that for many years past some connection had always been supposed between electricity and magnetism. The introduction of the Voltaic battery, at the beginning of the century, had led the path of direct experiments upon the subject; and those performed in 1814 by Mr. Children, at Tunbridge, *ought* to have enabled us to anticipate the great Swedish discovery made in 1819 by Oërsted, by whom the particular influence of the electric current upon the magnetic needle was made apparent. So simple was this, that it had often puzzled the lecturer to account for its previous non-discovery. But he believed that this want of success was wholly owing to the effect of preconceived notions in the mind—such as the assumed facts of a north and south pole to every magnet, and their tendency to direct it. This action of the electric current was capable of producing both light and heat, as well as of altering the chemical constitution of bodies. Light and heat were both experimentally produced, and water was by this means also decomposed. Among the elementary facts evolved was this, namely, that dynamic electricity is always associated with magnetic power; or, wherever the electrical current passes, magnetism is always associated with it. By means of a copper coil of wire, surrounding a bar of soft iron, and a current of electricity induced in the wire, the bar becomes magnetic, but only so as long as the contact prevails, or the electric circle is complete. This power, or force, is increased by increasing the number of coils of the wire. The modes of making and of breaking this current were then shown by experiment, and also its beautiful application by Mr. Shepherd to the clock in the south transept of the Exhibition Building. Professor Wheatstone had been the first, however, to apply the principle in the electric telegraph. All the parts of this clock were then exhibited in portions of the clock itself, or in working models, or well-prepared diagrams; and a turret clock, three bracket clocks, and table clocks were exhibited, keeping uniform time. The striking part of the machine was produced by a separate apparatus. Mr. Brande, after noticing Mr. Payne's electric clock, now in use at the Electric Telegraph Office in Lothbury, asserted his opinion that this new horology was in its very infancy. The importance of this branch of science cannot be exaggerated. Mr. Shepherd's clock was already in extensive use; in one large establishment in the city no less than between 50 and 60 of the apartments had each a dial, which was regulated by wire attached to the works a long way off. The arrangements for keeping up the action were very simple; and it had been found that two pairs of Smee's battery had kept a clock in action for twelve months. A clock of this description is now placed in the Tunbridge station of the South-Eastern Railway; and it has been proposed, by means of these clocks, to make the time at all the metropolitan termini equal. The Astronomer-Royal had suggested a mode of effecting this, by connecting the proper wire and battery with the falling ball on Greenwich Observatory. It was also proposed that the connection should be extended to the great clock to be put up at the New Palace of Westminster.

Friday Evening, 6th February.

The Duke of Northumberland in the Chair.

"Mr. Scott Russell, on Wave-line Yachts and Ships," having been announced as the discourse, an audience larger than usual assembled, and were highly gratified and amused with the subject and its treatment by this gentleman, who has for so many years devoted his attention to it. The origin of the lecture was to be traced to the easy victory gained by the United States' yacht "America," over our own little craft the "Titania;" and the questions proposed to be answered by Mr. Russell were, 1st, Whether the Americans were really superior to us in nautical skill? and, 2dly, Whether we are to be contented with being, for the future, their imitators, or whether we have not new ground from which to start, in these matters, on a new career? Twenty-three miles an hour had been attained by some of the American river steamers. This rapidity had not been exceeded by us. We had also been beaten by their passenger-ships before the era of ocean steamers. Their ships of this kind were the finest ships in the world. On the first introduction of ocean steamers, and since, we have excelled them, although they now come nearly up to us. Those of our vessels which are employed in the China trade scarcely rival the transatlantic clipper-ships, whose performances have surprised our best shipowners. There are physical causes of this state of things, and one moral one: the latter being the very strong prejudice which John Bull has for anything of novelty. The Americans have a prejudice quite the reverse of this. While England abides by a thing because it is old, America takes it—in almost every case, right or wrong—merely because it is new. Mr. Russell proceeded to detail the peculiarities of ship-building, to which he attributed our recent defeat, and adverted to the difficulties of treating the subject, which was one of extraordinary complexity, when the character of the curves composing a vessel is duly considered. He stated, first, that the portion of the vessel under the water was more to be thought on than that above the surface. He illustrated, by diagrams, the relations of an ordinary vessel and the *America* and *Titania* in these respects. The water-line was of the next importance. This is that line on the vessel, as seen from beneath, which touches the surface of the water, the proper form for rapidity being somewhat similar to that produced by two pieces of card-board or paper, the extremities being slightly compressed. He enunciated various other points requiring attention in ship-building—amongst others, what are technically called the ribbon-line, and the vertical section, called the longitudinal plane of immersion. All these refer to the geometry of a ship. The object of ship-building is to give all these desirable lines in a given model. The qualities of a vessel thus constructed are, first, a given power of carrying a load, sometimes called the buoyant power. This is ascertainable, with certainty, by reference to the weight of water displaced. The tonnage is found by simply subtracting the weight of water displaced from the weight of the vessel. The width of the midship section is to be regarded: upon the great breadth at the water-line depending, what Mr. Russell called the *stand-up-ativeness* of the vessel. He amusingly alluded to our law, recently abrogated, which, in effect, commanded, "Thou shalt not build a vessel broad at the water line." He showed how erroneous had been the rule of the Yacht Club as to reckoning the tonnage by measurement of the keel, and which resulted from our old law. There were only twenty tons difference in the loads which the *America* and *Titania* could carry; yet the power of sail in the two vessels was as $1\frac{1}{2}$ to 1. Although the *America* possessed only 15 per cent. greater tonnage, the mode of adjusting her sails obtained for her 50 per cent. greater power to carry it. He then explained, that what may be called *weather-iness* depends on the vertical section; and proceeded to show the element upon which speed is to be effected. The Americans had beaten us by practically applying the principle of the wave-line, which we had long since shown to be the correct form. The *America* was constructed upon this principle. By a coincidence, this line in both the vessels was nearly identical. The old water-line was in shape nearly like a salmon. On the introduction of steam-ships, the line at the bow was first made straight from the arc of a parabola. The old form was to make it a convex curve, and to avoid a concave curve; but for the last fifteen years the concave line had been endeavoured to be attained. Again, the old course of construction was to make the broadest part about $\frac{2}{3}$ from the bow, and $\frac{1}{3}$ from the stern. In the *America* this proportion, according to the true law, was exactly reversed. Singular enough, the *Titania* was similarly constructed in this respect. One of the results of the investigations, instituted by the British Association for the Advancement of Science, had been to show the form of a wave of displacement, or, as it is termed, a wave of the first order, and which was found to be the wave-curve which water would naturally take when disturbed. The Americans had copied this from us, and had, by the cut of sails and otherwise, pointed us to further improvements. By these means the *America* could sail a point nearer to the wind than the *Titania*; and observation and experiment had shown that, instead of the sails being beautifully *bellied* out, the more they were made like a flat board the greater their power of resistance, as was also proved by the best mathematicians. The *Titania's* sails had all, accordingly, been altered since her heroic defeat, and she now sails a point to the wind nearer than she did.

Friday Evening, 13th February.

The Duke of Northumberland in the Chair.

Mr. W. R. Grove, in a discourse "On the Heating Effects of Electricity and Magnetism," exhibited some very novel and ingenious experiments, in confirmation of views which he had suggested in his work on the co-relation of physical forces, and by which he sought to do away with our prejudices as to these agents being fluids impinging upon matter, and referring them, with, as he maintained, greater truth, to certain elements in the constitution of matter itself. He concisely detailed the history of our knowledge of these subtle physical agents, and alluded to the changes which had taken place in our mode of thought upon them, by our greater knowledge of the effects produced. The word *gas* was taken from the German word *geist*, a ghost, or supernatural spirit. This word was first used by Van Helmont, who may be said to have been the turning link between the alchemist of old and the modern chemist. In using it, he evidently clung to the ancient idea attached to all *invisible* agency. Torricellis's discovery first gave some materiality to the idea, and heat, light, and sound became to be considered imponderable bodies. Numerous theories were afterwards framed on the hypothesis of their being fluids. In 1799, sound had been referred to the undulations of an ether. It had now, however, been demonstrated, mathematically, to proceed from a peculiar species of motion. The electric spark was also supposed to be a fluid. Mr. Grove then referred to a former lecture, in which he had attempted to suggest a dynamical theory of heat. If we may imagine anything, why not a power changing the operation of gravitation? He showed, by experiment, a molecular change in matter, both when electrified and magnetised. By the rapid expansion and contraction of a band of caoutchouc, a degree of heat was produced which was made very apparent by its action on a thermascope. Considerable heat was also shown

to be induced in a magnetised bar of soft iron, when the poles were rapidly changed. He said he had ascertained that the difference between the light obtained by a voltaic discharge, and that by electric action, was in degree only. Many other experiments were shown, by which he would prove that a change not only takes place in the two points of any such discharge, but in the space between. These experiments were made with M. Gassiot's battery of 500 cells, and 10,000 feet of copper-wire coil, which, in one of the experiments, melted instantaneously, to complete fluidity, a platinum wire brought into proximity with the surface of water. He concluded a most interesting discourse by adverting to the necessity, in endeavouring at progress, to get rid of all hypothetical deductions, and to lessen the number of postulates; and, objecting to immediate utility being our proper object in such pursuits, held up to reverence those efforts which are the result of that pure love of knowledge, the intensity of which is ever in proportion to the greatness of our faith.

Friday Evening, 20th February.

The Duke of Northumberland in the Chair.

Mr. F. C. Penrose, who has for many years devoted his attention, on the spot, to the remains of Grecian architecture, entered upon the subject of some of the relations of science to architecture, considered as a fine art. After referring to the leading historical associations, and concisely detailing the significance of that to which, in our own times, the term *æsthetic* is applied, he proceeded to mention the observations which had been made by others, and himself, upon some *prima facie* eccentricities adopted by the ancient artist in the construction of one great edifice, the Parthenon of Athens. It is somewhat singular, and not without great significance, that these eccentricities have been found referrible to rule, founded upon the most subtle law affecting our species. Thus it has been proved, by actual admeasurement, that the pillars supporting the centre of the ends of the Parthenon are longer than those supporting the corners—the length gradually diminishing from the centre to the terminals. This difference in length of the pillars gives a concave form to the architrave above, but which really has the effect of giving it the appearance of a straight line. Again, the pillars are slightly made to incline out of the perpendicular, more and more as they extend towards the corners, while the pillars, instead of being actually straight, are slightly compressed about the centre of the shaft. All the lines of the ornaments and other parts were, likewise, shown to partake of a peculiar character of curvature. Mr. Penrose, by the aid of some very beautiful diagrams, many of them extremely ingenious, demonstrated, in a novel way, to what these vulgarly considered aberrations owe their origin, and how they contribute, in the most natural manner, to the great beauty of that temple which, from the time of Pericles to our own, has been so justly considered peerless. These were referred, ultimately, to the lines produced by conic sections. Our readers may remember Mr. Penrose as the inventor of the heliograph, an ingenious instrument for drawing spiral curves of uniform diminution, involving the rare union of mathematical knowledge and manual skill, and which was to be seen in the Great Exhibition, and, as transplanted from there, in the winter collection of the Society of Arts.

SOCIETY OF ARTS.

Wednesday, January 14, 1852.

Sir John Boileau, Bart., in the Chair.

Professor J. Lindley, F.R.S., proceeded to deliver his discourse on "Substances used as Food," being the sixth lecture on the results of the Great Exhibition.

He commenced by stating, that from among the 700 or 800 different substances which were shown, it was absolutely necessary for him to select only a few, distinguished either by their almost cosmopolitan character of utility, or by their singularity. Among these, however, were many which were either so familiar, or of such minor importance, that it would scarcely be necessary for him further to allude to them than by name; for instance, the birds' nests, which are used almost exclusively in China, and the easternmost portion of our eastern empire. He considered it more advantageous, in the limited time afforded him, to notice, rather, the new preparations or manifest improvements in alimentary substances.

He noticed the extraordinary excellence of the wheat produced in our South Australian colony, and one particular sample from the neighbourhood of Adelaide, which must be considered the very finest wheat ever known to have been grown, averaging 70 lbs. to the bushel. The Spanish white wheat had formerly been considered the best quality of that kind of corn; but our large colony certainly took the lead at present. The neighbourhood of Castile, nevertheless, still stood very high in this matter, and several very fine samples were exhibited from that locality. The Spanish wheat, moreover, must be considered only as a curiosity; as, from peculiar circumstances, it is not in the English market. Dr. Lindley went on to say it was a mistake to imagine that we could produce in England either of these better qualities from seed which might be imported; for the superior quality of all wheat was greatly owing to local circumstances of climate, &c.; and, indeed, experiment had proved that such seed, cultivated in the British isles, produces only wheat of an inferior quality to that commonly grown here. This showed that the peculiarity of these better wheats was not constitutional, but dependent on other causes. Some kinds of corn were, however, differently situated, and depended for their superiority not on adventitious circumstances, but on constitutional characteristics.

The lecturer then alluded to the experiments which have been made in hybridising wheat and cereal crops, and showed, by many examples which had been deposited in the Exhibition, how successful these experiments had been in proving that, by carefully blending certain varieties, wheat could be produced of superior quality, both in grain and straw, to the parent plants. Most of these results had been obtained in Scotland and in Warwickshire.

He noticed the superiority of the *arrow-root* produced in West Australia over that usually obtained from St. Domingo. Sir William Hooker had favoured him with specimens of bread made in Scinde and New Zealand, from the pollen of the common bull-rush growing there. Bread had also been made from the pollen of other plants. It was singular that this should be the only use to which this peculiar product was known to be applied. And he observed upon the curious circumstance of the application having been made in two countries so widely separated from each other, without any known communication between them.*

As a minor matter, he referred to some *dried plantains* which, so far back as 1835, had been sent over from Mexico. From some of these exhibited on the table, it appeared that they possessed the desirable quality of keeping good for a length of time; and, believing that there was no good quality belonging to figs which was not to be found in the plantain, he suggested that they should come into commerce.

As to the important subject, to which public attention had been recently so unpleasantly attracted—viz., *preserved provisions*, he would say a few words. He noticed, as among the principal ones, dried vegetables, such as red cabbage, &c.; and fruits, particularly the apples and pears largely prepared in France. These were all simply dried at a certain temperature—not too high and not too low—and, when dried, were immediately ready for use. The French navy had reported in favour of their extensive use. This subject was of far more importance than, on first thought, it appeared. It was known as a fact, that many navigators, particularly those of the Arctic seas, had, after a time, become tired of the preserved meat, although very fresh, but that they did not tire so soon of the vegetables, the use of which was thus placed within their power. He then alluded to the preparations from *blood*, particularly the blood-cakes from Italy. He described the flavour of them as not disagreeable, but decried the use of this substance for such a purpose. If the advantage of its use were considered as three-fold, it had been proved that, as employed for manure, it might be represented as fourteen-fold. He alluded to some beef, hashed in 1836, and still retaining all its good qualities, as a better example of preserved provisions. The new *meat biscuit* from Texas, was a far more important condiment; and, from the ease with which it might be prepared, he was induced to believe, that in it a new kind of serviceable food was likely to be brought soon into general use. Ten pounds weight of this biscuit would be sufficient for an active man for thirty days, or rather more than five oz. per day. It was already largely used in the American sea-service. From an analysis made by Dr. Playfair, it had been found that it contained 32 per cent. of the nutritive quality of flesh and starch unchanged. It was in itself tasteless; but pounded and made into a broth, and flavoured with salt, it was really very agreeable, as we had an opportunity of ascertaining after the lecture. It was capable of being kept perfectly good for a very long time, and was made very simply, by boiling down beef, and mixing the essence obtained with the finest flour. About five lbs. of good meat produces about 1 lb. of biscuit. Where, in America, cattle are now killed for the hide and the bones only, it might form a staple manufacture of increasing importance to the well-being of many nations.

Coffee and *cocoa* were not greatly noticeable in the Exhibition. The admirable quality of the cocoa from Trinidad was distinguishable. Cocoa is the foundation, as is well known, of chocolate; but the best we have of this substance comes, some from France and some from Spain. He referred to an ingenious method exhibited of purifying the coffee-bean from the kind of light-coloured epidermal covering which is noticeable in it. He also alluded to the extracts which had lately been made, called *theine* and *caffeine*, and to a peculiar kind of seed-vessel of a plant, grown in Turkey, and proposed as a substitute for coffee.

Sugar was not well represented in the Exhibition. The French, who obtained almost all their sugar from beet-root, had exhibited a curious process in its manufacture, by means of which great advantage had arisen in the amount formerly produced. The *molasses* were, until lately, eatable only by hogs. The taste was nauseous, and accompanied with a bad smell. The *hydrate of baryta* was made to produce *saccharite of baryta*. The improvement had resulted from getting rid of the baryta by carbonic acid, and thus leaving the sugar free from impurity in a state of *eau sucré*; 45 per cent. of sugar was thus recovered from the refuse. On this subject he begged to refer to the forthcoming report of the jury, as containing further interesting particulars.

As to *tea*, he alluded to the rising importance of its manufacture in our eastern world. Mr. Scott, about 1826, conceived the idea of cultivating this now almost necessary plant in Assam. Inquiry was instituted into the project, and, upon a report in its favour, a company was formed. Assam, however, does not produce a fine, but a useful mercantile tea. An experiment was proposed to cultivate it largely in the Himalaya district, and Mr. Fortune having reported in its favour, 650 acres are now in culture, producing a new centre of industry. Both green and black tea had been prepared, and the experiment had been considered so completely successful as to open the prospect, at some future time, of our large trade in this article passing from China to India. He alluded to the ingenuity of the manufacturers of the celestial empire, in the nefarious practice of fabricating what they themselves significantly term lie-tea, being a spurious and deleterious imitation of fine gunpowder tea. He also observed, that the tea made of the flower of pekoe, which was exhibited in the Chinese department, and as being worth fifty shillings per lb., was not of such exquisite flavour as might have been imagined; indeed, an European palate is puzzled to know to what virtues it is indebted for its high price in the Chinese market.

* This is another volunteer fact, supporting the hypothesis as to *co-ordinate invention*, which is maintained in the papers on this subject in another part of our *Journal*.

"Of course the finest *tobacco* is from Havannah." This is not quite so correct a conclusion. Some particular small districts in Havannah do produce the best tobacco known, but this is rarely exported. Tobacco had been shown from Trinidad, and some from the Russian and Caucasian provinces. The punishment of getting through an Algerine segar was terrible. The English-made segar, however contrary to the opinion of the knowing world, was not distinguishable from that imported from Havannah, except in external appearance—the English not having yet attained to the peculiar mode of effecting this. The segar manufacture is an important one, as may be estimated from the fact of 630,000,000 of segars being made annually in the German commercial union district alone. Some Portuguese segars were likewise of remarkably good quality.

Dr. Lindley finished his discourse by mentioning the article *honey*, of which a great deal from Mount Hymettus, and all parts of the world, was represented in the Exhibition. And he incidentally noticed a new modification of the common straw-banded beehive, and to which the lecturer gave the palm above all others. It was designed by Mr. Milton, of Marylebone Street.

All the usual honours were decreed unanimously to Dr. Lindley for his interesting lecture, and Mr. Cole, in seconding the vote of thanks, took occasion to allude to the Commercial Museum, now forming under the Great Glass House, and to the gratifying fact, of between £10,000 and £12,000 worth of specimens having been already presented to the Royal Commissioners towards the end in view.

WEDNESDAY, FEB. 4.

W. FOTHERGILL COOKE, ESQ., V.P., IN THE CHAIR.

James Glaisher, Esq., F.R.S., read his lecture on "Philosophical Instruments and Processes." This discourse was of a more technical character than those which have preceded it, and, for proper understanding, would require such space as we cannot afford for explanatory diagrams. It must at present suffice to say, that Mr. Glaisher particularly alluded to Sim's improvement in illuminating telescopes—to some ingenious experiments (devised in the United States) which may lead to a mode of discovering the longitude—to an equally ingenious compass, invented in France, by inspecting which allowance may be made for disturbing causes immediately surrounding it—to the catadioptric lighthouses—and to Mr. Brooks' self-registering meteorological instruments, as exhibiting the last advanced grade in these matters; suggesting, at the same time, from them and some less important things, great hopes of early further progress in our investigations, by such means, into the phenomena of nature.

THURSDAY, FEB. 5.

The Chairman of Council, in conformity with the bye-laws, read the usual address of the Council to the Society. Among other topics, he referred to a recent alteration in the bye-laws, by which the council have the appointment of thirty committees from among the members, to watch over and report, from year to year, upon the subjects which would have been included in the thirty classes into which the Great Exhibition was divided. The committees have been appointed accordingly.

The new colour-box—to contain ten pure colours, and three hair pencils, and to be sold for a shilling—will be published in about six weeks; and the new case of mathematical instruments—to contain a 12-inch rule with scales, a rectangular triangle and pair of compasses, with pen and pencil leg, fitted into a suitable box, and to be sold for 2s. 6d.—will also be soon ready; as likewise another set of instruments for proficients in drawing, which, it was stated, would be found very complete and portable, and would be sold for the moderate price of 6s.

Mr. George F. Wilson, managing director of Price's Patent Candle Company, subsequently read his paper on the "Stearic Candle Manufacture," and which was illustrated by numerous specimens of the raw material and of the completed article.

ROYAL SCOTTISH SOCIETY OF ARTS.

JANUARY 26, 1852.

"On the Relative Advantages of the English and American (aerial), and the Prussian (subterranean) Electric Telegraphs," by Dr. G. Wilson.

Dr. G. Wilson's object in this exposition was to bring under the Society's notice the relative advantages of the methods followed in England and America on the one hand, and in Prussia on the other, on the insulation and protection of the wire, which forms the largest and most costly portion of the electric telegraph. After explaining in detail the mode of constructing and arranging the wires in this country and on the Continent, the author discussed the questions of the relative excellence of the insulation attained by the two systems, the degree to which each is exposed to disturbance by atmospheric and terrestrial electricity and magnetism, and the relative cost, responsibility, and durability of the aerial or suspended insulated wire, and the subterranean or buried one. The general conclusion come to was, that although our experience of the subterranean wire was much less than that of the suspended one, the introduction of gutta percha had furnished such facilities for insulating the buried wires, that it was not improbable they would supersede in England the present arrangement, as the principles involved in the subterranean telegraph were sanctioned by all our engineers.

"On a suggested Explosive Projectile for Artillery," by Mr. G. D. Howell.

"On a Safe Lock," by Mr. J. Whyte, Easdale.

"On an Improved Mode of giving the greatest effect to an Overshot Water-Wheel," and "An Inclined Plane for loading and unloading Carts," by Mr. D. Vallance.

"Suggestions as to the origin of the fire which caused the loss of the Amazon," by Mr. A. Bryson.

FEBRUARY 9.

"On the theories of Galileo and Leibnitz touching the Strain and Strength of Materials, and on the position of the Neutral Axis in Beams, and their actual strength in reference to the resisting forces of Compression and Extension on opposite sides of this line," by Dr. G. Lees.

"On a Cast-Iron Swing Bridge, constructed for Peterhead Harbour by Messrs. Blaikie, Panmure Foundry, from designs by Messrs. Stevenson, Civil Engineers," by Mr. J. Lawrenson Kerr, C.E.

The swing bridge erected in 1850 over the canal, which was cut through the isthmus separating the north and south harbours of Peterhead, is of cast-iron, and consists of two compartments or leaves. The span is 41 feet 6 inches; rise, 5 feet 6 inches; breadth over all, 20 feet 5 inches; and total length, 99 feet 6 inches. The depth of the exterior girders at the crown is 15½ inches, and of that of the interior 11½ inches. The weight of each leaf is 91½ tons, of which 13 tons are ballast. A man with one hand can easily work the gearing which causes the leaf to revolve.

FEBRUARY 23.

"Memoranda in regard to the history of Steam as a power for propelling Ships, &c.; and, in particular, as to the late Mr. William Symington's connection with that subject," by Mr. William Grosart, Falkirk.

"Description and Drawing of an Improved Instrument for Drawing Ellipses," by Mr. George H. Slight, Engineer, Leith Walk.

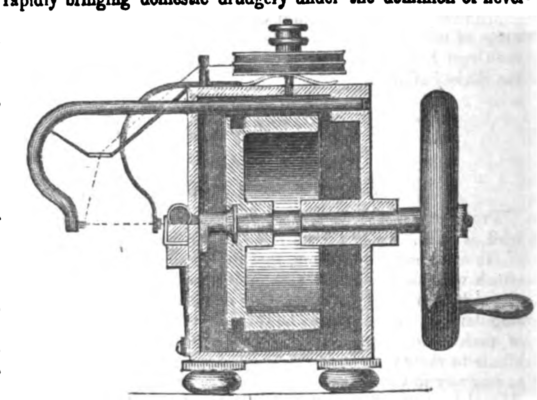
"Continuation of Mr. Grainger's papers on the Drainage of the Haarlem Lake."

"Description of a Chromatic Fac-Simile Process or Method of Colour-Printing from Wood-Blocks and from Stone," by Messrs. Leighton Brothers, Red Lion Square, London.

"Description and Drawing of a Boot-Maker's Plane," by Mr. L. Niman.

MONTHLY NOTES.

MECHANICAL SEWING.—Mr Judkins' sewing machine, which, although the invention of an American, was shown in the Exhibition amongst the productions of the United Kingdom, is an important contribution to the many contrivances which are now rapidly bringing domestic drudgery under the dominion of never-tiring mechanism. Our engraving represents a vertical section of the machine. It is suited either for straight line, or curvilinear sewing, and works at the rate of 500 stitches per minute. The rack in which the cloth is placed, is moved forward by a spring action a certain distance at each stitch.



Two threads are used, one being carried in the shuttle, and the other drawn from a reel at the top of the machine, and passed through the cloth by the point of the needle, so that, when withdrawn, both threads become locked together, forming a durable stitch. When a curved line is to be sewn, the straight rack is removed, and a curved one substituted for it at the side of the machine.

RÉMOND'S PAPER-BAG MACHINE.—M. Rémond of Birmingham, whose inventions have repeatedly added to the interest of our pages, has now in operation a novel and effective machine for the manufacture of paper-bags. Paper-bags of all sizes, and qualities of material, are made in this machine, which only occupies a space of 6 feet by 4 feet, and is managed by two persons, who can turn out 20 small—in trade language, 7 lb.—bags per minute, or 12 large—from 12 to 20 lb. Compared with the manual process, the machine with two attendants does the work of ten unassisted bag-makers. The bags are not made exactly like the common ones, inasmuch as they present a full square or round base, so that they will stand open and upright of themselves. The address of the party using the bags, or any device, may be printed on during the folding action.

THE LATE DAVID BREMNER, ESQ., C. E.—In announcing the death of Mr. Bremner, the Engineer to the Clyde Trust, at Glasgow, we feel that we have a peculiarly melancholy task before us. In him, the promoters of the Clyde improvements have lost an eminently valuable man, and we ourselves a true-hearted personal friend. Mr. Bremner was the second son of James Bremner, Esq., of Wick, Caithness, who won so large an amount of professional regard, by the rescue of the

Great Britain, when ashore in Dundrum Bay—a severe task, in which he was ably assisted by the subject of our present notice. He was appointed to the important position of engineer to the Clyde works in 1846, and his skill, and careful attention to the duties of his post, have earned for him a higher position in the estimation of those who knew him, than is usually the lot of so young a man. He died at the age of thirty-three, being thus early carried off, by inflammation of the lungs, brought on by getting wet during his professional avocations.

East India Brick-Making.—At the great works of Roorkee, about a hundred millions of bricks were used, being required at the rate of 170 lakhs a year. The great difficulty in obtaining these bricks arose from the perverseness of the men employed to mould the clay. The brick-making season in the north-west, extends from the 1st October to the 15th June, and supposing each man to turn out 800 bricks a-day, 105 brick-moulders would be required to complete the number annually required. There existed great difficulties, particularly on the score of expense, in collecting and maintaining so large a number of skilled workmen, and when collected they were found to be extremely difficult to manage. The slightest reproof to one of their number was sufficient to induce the whole body to march off the field with their moulds, and in one instance they played this trick twice in a single week. Col. Cautley, while in England, endeavoured to procure machinery which would obviate the difficulty, and finally selected Ainslie's machine. It was not, however, found to answer in this country, as the bricks were all torn at the edges, and broader at the bottom than the top. Another attempt was therefore made by Col. Cautley, with a machine which he had observed at the agricultural meeting in Northampton, and which bore the name of "Hall's Patent." This machine had been patented in England by Mr. Ransome, the eminent Ipswich ironfounder, and a member of the firm whose colossal instruments for observations are so highly extolled by Sir F. Head One of these machines was brought out, and placed under the superintendence of Mr. Finn, the executive officer of materials at Roorkee. It succeeded admirably, and turned out every day upwards of 10,000 perfect bricks, thus performing the work of twelve brick-moulders. The establishment required for bringing the clay, and working and performing all the other labours necessary to the turning out of 10,000 bricks per day, is thus stated:—Eleven excavated the clay and carried it to the pug-mill cistern, average distance 130 feet; two supplied the cistern with water, and cleared up the drying ground; three filled the pug-mill from the contents of the cistern; one cleaned and sanded the moulds preparatory to passing them into the machine; one served the machine with empty brick moulds; one on the wheel pressed the mixed clay into the moulds; one on the lever forced out the mould; one on the mister or strike cleaned the top of the bricks, and raised the moulds to the heads of the carriers; six carried the loaded moulds from the machine to the drying ground; one relieved the carriers of the moulds, and placed the bricks in regular lines on the drying ground—total, 28 bildars. Each of these men received six rupees a month, and the total cost of wages is, therefore, less than five rupees and a half a-day. As soon as the brick-moulders found that their employers could dispense with their services, with true native instinct they became tractable and active; and whereas they were accustomed to turn out only 800 bricks a-day each, and sometimes less than that number, they now turn out 900 perfect bricks in the same time. Nor is the saving of expense less remarkable than the increase of productive power. The original price of each machine in England was Rs. 960, and the total cost on its arrival at Roorkee, Rs. 1,561; but Col. Cautley has succeeded in making the machines in Roorkee itself for Rs. 500. With these machines the price of a lakh of bricks is Rs. 54—1. On a large scale, 976,016 bricks were made for 670 rupees. We are unfortunately not informed of the exact expense of making bricks by hand, under the old system, at that station; but we know that in Bengal they cannot be made under Rs. 150 a lakh, and in many places the expense is considerably greater. The Government save, therefore, at least Rs. 90 per lakh, or nearly a rakh of rupees in this single undertaking at Roorkee, and this by the employment of European machinery, the most expensive of all English manufactures. Any enterprising individual who would construct and work a few of these machines in Bengal, would bring down the price of bricks, to the great benefit of the public, and not less, perhaps, of himself. The selling price, within 60 miles of Calcutta, is at this moment from Rs. 400 to Rs. 450 per lakh.

Mileage Performance of the Edinburgh and Glasgow Railway.—The passenger engines on this line have run, during the last half-year, 229,951 miles; the goods, cattle, and mineral engines, 173,174; and the ballasting engines, 8,507: total, 404,632 miles. The return of working stock shows that the line possesses 67 locomotive engines, 62 tenders, 12 break waggons, and 56 coke waggons; 63 first-class and coupé carriages, 14 composite, 44 second-class, 94 third-class, and 10 fourth-class carriages; 29 horse-boxes, 23 carriage trucks, 12 guards' vans, 2 omnibuses; 410 goods waggons, 771 mineral trucks, 116 sheep and cattle waggons, 25 luggage vans, 20 cart trucks, 13 parcel trucks, and 6 timber trucks.

Rapid Movements of the "City of Manchester" Screw Steamer.—This vessel—commander, Captain Little—on her last trip, arrived from Philadelphia on a Tuesday evening, just too late to dock, and no work could be done until 10 o'clock next morning, when she was berthed; and about 8 o'clock on the Friday evening she left her berth for sea, and passed the Rock at 20 minutes to 12, having been just fifty-eight hours in a working berth, during which time she discharged 850 tons of cargo, and loaded 700 tons of cargo, and 820 tons of coals; turning over, altogether, 2,370 tons. Her inward cargo, consisting of 11,802 bags of wheat, and barrels of flour and cloverseed, was discharged in little over ten working hours, being at the rate of nineteen packages per minute, or eighty-five tons per hour.

Smoke Patents.—A few words on smoke patents, and a very few will suffice; for although the patents are numerous, the schemes are reducible to a very small number of typical forms. The multiplicity is the result rather of paucity than of fertility of invention; still we are compelled, in common civility, to speak with respect of the indefatigable and hopeful perseverance evinced by this class of small inventors. It is indeed difficult to shake off the feeling of melancholy which is sure to fall on the mind, whenever we reflect to how little purpose all the time and industry have been expended, which the long list of names on the smoke-roll implies; it is humiliating to think that smoky chimneys still exist, that they have not disappeared before the valiant attacks so incessantly made upon them, and survive only as matter of history, with corroboration from certain black bricks carefully laid up in our museums, among the relics of other times, for the benefit of the curious and the sceptical. But if industry and perseverance are always to have their reward, then the philosophers' stone and the elixir of life ought long ago to have been common property, and all our machinery ought to have been moving of its own good-will. There is another element besides persevering industry necessary to success in all schemes pretending to deal with physical conditions; there must be a right interpretation of those conditions, and a full obedience to the laws of their phenomena. Nature must be followed, not coerced. Smoke-burners have occasionally professed as much; but they have rarely taken the trouble to inquire deeply into the will of the oracle. With some honourable exceptions, the genuine smoke-burner, like the perpetual motionist, despises all theory; he assumes to be practical, and claims a merit in declaring that theoretical truth is practical fallacy. He will juggle Nature by means of hollow bars, moving bars, piston grates, radiating bricks, air-tubes, valves, and such like *practical* means. And, strong in his empiricism, not only does he coddle himself into a belief that he can burn smoke, such a feat is not enough; he boldly proclaims "an average minimum saving of fuel of from 25 to 30 per cent." The principles endeavoured to be explained in these pages, unless they are much more inadequately expressed than it is hoped they are, sufficiently indicate the value of all such preposterous pretensions. It was said that the typical forms are not numerous; and in fact all the schemes for smoke-burning by patent are arrangeable in four classes: one class depending on the efficacy of heat alone to purify the smoke and make it clean; another recognising the necessity of admitting air to the furnace to accomplish the end; a third recommending injections of water or steam; and the mechanical class relying on the virtues of mechanism alone to do the furnace-trick.—*Notes towards a Solution of the Smoke Question.*

Reclamation of Land at Liverpool.—The Liverpool Chamber of Commerce has just now before it the consideration of the construction of a breakwater at the mouth of the Mersey, and the consequent reclamation of the Great Burbo, and other sandbanks. The movement is due to Mr. Murray Ross, who backs his proposition with the opinion of Mr. George Rennie, who sees no difficulty in bringing in the vast extent of sands along the sea-coast of Wirral, adding 20,000 acres to the county of Chester. The engineering estimate is £805,000, the value of the land being taken at £1,200,000, leaving a direct profit of nearly £400,000. If attention is successfully aroused in the matter, we may yet, perhaps, have hopes of the execution of the long-projected and procrastinated Morecambe-Bay scheme.

French Improvements in Growing Wheat.—France occasionally furnishes us with some curious offshoots of her inventive genius. Amongst her recent schemes is one for "increasing the produce of autumn wheat," patented by Mr. D'Urcle, a farmer of Paris. The inventor grounds his discovery upon the fact—positively ascertained "by study and repeated experiments"—that autumn wheat is not an annual, but biennial, like the beet-root and carrot class, and he therefore proceeds to develop the alleged biennial properties by a novel plan of planting and treatment, for the increase of the produce. The ground is to be well manured, either before winter or at the beginning of spring, to receive the seed between the 20th of April and 10th of May, this time being chosen to prevent the chance of blossoming during the year. But the time of sowing may be advanced from year to year; for, if it were not for the present degeneracy of the plant, it might occur now in March. Each grain is sown separately, allowing it a large area of ground if the soil is rich, but diminishing according to its sterility. It is deposited in rows in holes at regular distances, from 9½ to 23½ inches asunder, in each direction, the holes in one row opposite the spaces in the next. Each hole is to contain 4 or 5 grains, 2½ inches asunder. When the plants have attained a height of four inches, all but the finest one in each group are pulled up, and this single one is then left for the harvest of the succeeding year. This curious process is stated to increase the produce very greatly.

ENGLISH PATENTS.

Sealed from 23d February to 18th March, 1852.

William Edward Newton, Chancery-lane, Middlesex, civil engineer,—"Improvements in the manufacture of coke, and in application of the gaseous products arising therefrom to useful purposes."—(Communication.)—February 23.

William Stirling Lacon, Great Yarmouth, Norfolk, gentleman,—"Improvements in the means of suspending ships' boats, and of lowering the same into the water."—23d.

Samuel Banes, Bethnal-green, Middlesex, master mariner,—"Certain improvements in apparatus to be applied to or connected with the cables of ships or other vessels when riding at anchor."—23d.

Charles Cowper, Southampton-buildings, Chancery-lane, Middlesex,—"Improvements in machinery for combing and preparing wool and other fibrous substances."—(Communication.)—23d.

Jean Theodore Coupler and Marie Amedée Charles Mellier, Maidstone, Kent, gentlemen,—"Certain improvements in the manufacture of paper."—23d.

Thomas Young Hall, Newcastle-upon-Tyne, coal owner and colliery viewer,—"Improvements in screens for screening coal and other substances requiring to be screened."—23d.

Richard Archibald Brooman, of the firm of J. C. Robertson & Co., Fleet-street, London, patent agent,—"Improvements in windmills."—(Communication.)—23d.

William Walker, Plymouth, Devon, Commander in the Royal Navy,—"A method or

means of ascertaining and indicating the deviations or errors of the mariner's compass."—23d.

James Pilling, Rochdale, Lancaster, spinner and manufacturer,—"Certain improvements in looms for weaving."—23d.

Peter Armand le Compte de Fontainemoreau, South-street, Finsbury, London,—"Certain improvements in gas-burners."—(Communication.)—23d.

Alfred Charles Hobbs, New York, America, engineer,—"Certain improvements in the construction of locks and other fastenings."—23d.

Thomas Walker, Birmingham,—"Improvements in steam-engines."—23d.

Samuel Boulton, Manchester, agent,—"Improvements in the treatment of metallic ores, and certain salts and residuary matters, and in obtaining products therefrom."—23d.

Henry Bessemer, Baxter-house, Old St. Pancras-road, Middlesex,—"Improvements in expressing saccharine fluids, and in the manufacture, refining, and treating sugar."—24th.

Russell Sturgis, Bishopsgate-street, London, merchant,—"Improvements in weaving looms."—(Communication.)—25th.

John Elce, Manchester, Lancaster, machinist, and John Bond, Burnley, in the said county, machinist,—"Certain improvements in machinery for preparing cotton and other fibrous substances; also in machinery or apparatus applicable to looms for weaving, and the tools employed therein."—26th.

Charles Reeves, jun., Birmingham, Warwick, manufacturer,—"Certain improvements in the manufacture of bayonets, swords, and other cutting instruments."—27th.

Charles John Mare, Blackwall, Middlesex,—"Improvements in constructing iron ships or vessels, and steam boilers."—27th.

James Pilbrow, Tottenham, Middlesex, civil engineer,—"Certain improvements in apparatus for supplying the inhabitants of towns and other places with water."—March 3d.

George Leopold Ludwig Kufahl, Christopher-street, Finsbury, London, engineer,—"Improvements in fire-arms."—3d.

George Wilkinson, Streatham-terrace, Shadwell, engineer,—"Improvements in ships and other vessels."—4th.

Alfred Trueman, Swansea, manager of copper smelting works, and John Cameron, Loughor, chemist,—"Improvements in obtaining copper from ores."—4th.

Alexander Parkes, Birmingham,—"Improvements in separating silver from other metals."—8th.

Edward Moseley Perkins, Mark-lane, London,—"Improvements in the manufacture of cast-metal pipes, retorts, or other hollow castings."—8th.

James Graham, Camden-grove, Peckham, Surrey,—"Improvements in treating ores containing zinc and the products obtained therefrom."—8th.

James Wanbrough, Albert-road, Mile-end, manufacturer, and William Allen Turner, Fish-street-hill, London, merchant,—"Improvements in the manufacture of flocked fabrics."—8th.

Frederick George Underhay, of Wells-street, Gray's Inn-road, engineer,—"Improvements in apparatus for regulating the supply of water to water-closets and other vessels, and in taps or cocks for drawing off liquids."—8th.

Enrico Angelo Ludovico Negretti and Joseph Warren Zambra, both of Hatton-garden, London, meteorological instrument makers,—"Improvements in thermometers, barometers, gauges, and other instruments for ascertaining and registering the temperature, pressure, density, and specific gravity of aeriform fluids and liquids, or solid bodies."—8th.

Alfred Vincent Newton, Chancery-lane, Middlesex, mechanical draughtsman,—"Improvements in machinery for combing wool and other fibrous substances."—(Communication.)—8th.

George Wright, of Sheffield, and also of Rotherham, York, artist,—"Improvements in stoves, grates, or fire-places."—8th.

William Edward Newton, Chancery-lane, Middlesex, civil engineer,—"Improvements in propelling vessels."—(Communication.)—8th.

Joshua Crockford, of Southampton-place, Middlesex, gentleman,—"Improvements in brewing, and in brewing apparatus."—8th.

Augustus Turk Forder, Leamington Priors, Warwick, solicitor,—"An improved fender."—8th.

Richard Archibald Brooman, of the firm of J. C. Robertson & Co., of Fleet-street, London, patent agents,—"Improvements in presses and in pressing."—(Communication.)—8th.

Charles Augustus Preller, Abchurch-lane, London, merchant,—"Improvements in the preparation and preservation of skins, and animal and vegetable substances."—(Communication.)—8th.

Uriah Scott, of Grove-street, Camden-town, Middlesex, engineer,—"Improvements in wheels and in springs, and spring-bearings for carriages."—8th.

John Henry Johnson, of the Offices for Patents, 47 Lincoln's-inn-fields, Middlesex; 166 Buchanan-street, Glasgow; and 20 St. Andrew's-square, Edinburgh,—"Improvements in weaving carpets and other fabrics, and in the machinery or apparatus employed therein."—(Communication.)—8th.

Walter Young, of Springfield Ironworks, Salford, Lancaster, millwright and engineer,—"An improvement or improvements in steam-engines."—8th.

Alexander Cuninghame, Glasgow, Lanarkshire, ironmaster,—"Improvements in the treatment and application of slag, or the refuse matter of blast furnaces."—8th.

William Pidding, of the Strand, Middlesex, gentleman,—"Improvements in mining operations, and in the machinery or apparatus connected therewith."—8th.

Peter Van Kempen, of West Ham, Essex, accountant,—"An improved refrigerator to be used in brewing, distilling, and other similar useful purposes."—(Communication.)—8th.

William Willcocks Sleigh, physician and surgeon, London,—"A counteracting reaction motive power engine."—8th.

Alexandre Hediard, of Rue Taitbout, Paris, gentleman,—"Certain improvements in rotatory steam-engines."—8th.

Paul Rapsey Hodge, civil and mechanical engineer, Adam-street, Adelphi, Middlesex,—"Certain improvements in the construction of railways and railway carriages, parts of which are applicable to carriages on common roads."—(Communication.)—8th.

Thomas Ellison, Queen's-road, Pentonville, Middlesex, painter, plumber, and glazier,—"Certain improvements in the manufacture of imitation marbles, granites, and all sorts of stones."—8th.

Pierre Henri Bareau, Paris, manufacturer,—"Certain improvements in the manufacture of carpets, velvets, and other fabrics."—8th.

William Smith, Park-street, Grosvenor-square, civil engineer, and Archibald Smith, Princes-street, Leicester-square, engineer and machinist,—"Certain improvements in electric and electro-magnetic telegraph apparatus, and in the machinery for and method of making and laying down submarine, submerged, and other such lines."—8th.

Colin Mather, Salford, Lancaster, machine-maker, and Ernest Rolffs, Cologne, Prussia, gentleman,—"Certain improvements in printing, damping, stiffening, opening, and spreading woven fabrics."—11th.

Benjamin Goodfellow, Hyde, Chester, engineer,—"Improvements in boilers for generating steam."—11th.

Joseph Denton, Rochdale, Lancaster, gentleman,—"Improvements in machinery or apparatus for manufacturing looped, terry, or other similar fabrics."—12th. (N. B. This patent being opposed at the Great Seal, was not sealed till the 12th March, but bears date the 23d February last, the day it would have been sealed had no opposition been entered.)

John Mercer, Oakenshaw, Clayton-le-Moors, chemist, and John Greenwood, Irwell Springs, Bacup, turkey-red dyer, both in Lancaster,—"Certain improvements in preparing cotton and other fabrics for dyeing and printing."—15th.

Francis Wheatley, Greenwich, Kent, gentleman,—"An improved safety cab-omnibus."—18th.

DESIGNS FOR ARTICLES OF UTILITY.

Registered from 18th February, to 16th March, 1852.

Feb. 20, 3129. J. Keable, Lambourn,—"Guard-frame for pig trough."
— 3130. J. Jones & Co., Sheffield,—"Goloshes for sheep and other cloven-footed animals."
21, 3131. G. Murrell, Chelsea,—"Anti-mephitical ventilator, or vapour dispeller."
— 3132. J. H. Noone & W. Exall, Camden Town,—"Spring-carriage head."
23, 3133. Brown & Redpath, Commercial-road,—"Apparatus for lowering boats from ships or other vessels."
— 3134. J. Smith, Coven, near Wolverhampton,—"Boiler."
24, 3135. J. Purdy, Oxford-street,—"Self-expanding bullet."
— 3136. J. H. Cutler, Birmingham,—"Pearl buttons."
— 3137. W. Woolford, Bradford, York,—"Seating of singe plates for singeing fabrics."
25, 3138. Brown, Marshall, & Co., Birmingham,—"Railway carriage."
— 3139. R. Best, Birmingham,—"Reflector."
— 3140. W. Proger, Newport, Monmouth,—"Safety and signal lantern."
26, 3141. R. W. Winfield, Birmingham,—"Curtain ring-hook."
— 3142. W. Soutter, Birmingham,—"Joint for copper and brass kettles and other vessels."
— 3143. C. N. May, Reading,—"Smoke preventer."
— 3144. J. Derrington and Co., Manchester,—"Tap or cock."
— 3145. C. W. Lancaster, New Bond-street,—"Rifle ball."
— 3146. C. W. Lancaster, New Bond-street,—"Rifle ball."
— 3147. C. W. Lancaster, New Bond-street,—"Rifle ball."
— 3148. T. & S. Knight, Southwark,—"Improved boiler."
27, 3149. Myers and Son, Birmingham,—"Universal India-rubber holder."
28, 3150. W. Dodsworth, Bradford,—"Spool motion."
— 3151. A. Gatti & E. Prinet, Clerkenwell,—"Self-acting card-case."
— 3152. J. Parkinson, Bury, Lancaster,—"Cock."
— 3153. H. G. Fuller, Greenwich,—"Apparatus for making sail thimbles."
March 1, 3154. T. Sullivan, Foot's-cray, Kent,—"Amphaton dandy-roller."
— 3155. E. Evans, Brixton,—"Screw gas-tongs, or wrench."
— 3156 H. Beckwith, Skinner-street, Snow-hill,—"Mould for hollow conical bullets."
— 3157. Parsons and Terill, Caledonian-road,—"Cooking apparatus."
3, 3158. The Grangemouth Coal Company, Grangemouth,—"Heating apparatus for hothouses and greenhouses, &c."
— 3159. B. M. Wilkins, Sutton, Coldfield,—"Running rein-bridle."
4, 3160. J. C. Stokes, Birmingham,—"Tap."
5, 3161. G. Fletcher & Co., Wolverhampton,—"Metallic lath for beds, sofas, couches, &c."
— 3162. H. Swift, Ipswich,—"Gutter or water-channel for footpaths and ways."
— 3163. P. Pearson, Manchester,—"Machine for folding paper bags."
— 3164. W. Austin, Farnham,—"Set of bricks for building walls, &c."
6, 3165. H. Kenyon, Liverpool,—"Fluted mill-tooth."
— 3166. J. Kealy, Oxford-street,—"Knife for turnip-cutters, &c."
8, 3167. H. Jones, Birmingham,—"Measuring tap."
— 3168. J. Finlay, Glasgow,—"Induction ventilator."
9, 3169. G. Benda, Basinghall-street,—"Fastening for Porte Monnaies and other articles."
11, 3170. J. Cooper & J. C. Forsell, Leicester,—"The crystal reel."
— 3171. D. Simpson, Lancaster,—"Regulating pressure tap."
12, 3172. H. Stephens, Stamford-street, Blackfriars,—"Adjustable pencil-point."
— 3173. Mr. Baillie, Bayswater,—"Safety letter-box."
— 3174. H. Doulton & Co., Lambeth Pottery,—"Invert block for the bottoms of sewers or culverts in stoneware."
— 3175. C. & J. Seagrief, Green-street, Park-lane,—"Portable wardrobe."
13, 3176. A. Marion & Co., Regent-street,—"Pencil cutter," (179 Provisional).
— 3177. C. Gray and Sons, Sheffield,—"Reaping machine-knife."
15, 3178. Well & Greenway, Birmingham,—"Fastening for doors, windows, &c."
16, 3179. W. Fife, Birmingham,—"Metallic pen."
— 3180. J. Morris and Sons, Astwood Bank, near Redditch,—"Needle-case."
— 3181. C. Rowley, Birmingham,—"Fastening for elastic bands."
— 3182. W. Stahl and E. Prinet, Yardley-street, Wilmington-square,—"New dividers and callipers," (110 Provisional).
— 3183. J. C. Boyd, Lower Thames-street,—"Double action or self-adjusting scythe."

DESIGNS FOR ARTICLES OF UTILITY.

Provisionally Registered from 18th February, to 11th March, 1852.

Feb. 26, 366. W. Eassie, Gloucester,—"Pole and bolster for railway and other trucks."
— 367. J. Thomson, Old Kent-road,—"Syphon gas-stove."
— 368. J. Weston & Co., Noble-street, City,—"Le distingué."
— 369. J. G. Wilson, Chelsea,—"Epanalepsian advertising vehicle."
27, 370. L. Cecconi, Brewer-street, Golden-square,—"Self-acting tuning-fork."
March 1, 371. R. Kerry, Surrey,—"Invalid's exercising-chair."
6, 372. J. Bedford, Seacombe, Chester,—"Ascending and descending friction and antifriction roller-blind pulley."
11, 373. J. G. Wilson, Chelsea,—"Rotary advertising vehicle."

TO READERS AND CORRESPONDENTS.

J. C.—Glasgow is supplied by two companies, the Old City Water Works on the Clyde, and the modern Gorbals Gravitation Works, deriving their supply from surface drainage into the streamlets Brock and Walton, near Barrhead. He will find detailed information, in reference to both companies, in Parts 5 and 6, Vol. I., of the *Practical Mechanic's Journal.*

A. F.—Read "Armstrong on Boilers," in any Mechanics' Institution library. See also page 276, Vol. III. *Practical Mechanic's Journal,* and the succeeding papers on the same subject.

Received.—"Meteorological and Astronomical Notices," by Professor C. P. Smyth.—"The Advantages of Tubular Drainage as Compared with Brick Sewers," by John Thomson, C.E.—"Tables for Calculating Cuttings and Embankments, &c.," by James Henderson, C.E.

T. P., U. S.—We shall be glad to see the furnace.

J. B., Colton.—His remarks will meet with our attention next month.

B. H. W., Rome.—We shall be glad to further his views here. We shall write fully by post.

E. W., Finsbury.—We have not yet received his full particulars.

J. H., Munich.—We should have much pleasure in giving a few unillustrated notes of the engine, if he will favour us with permission to do so.

J. P. wishes to know "how to cut a differential screw, so that the pitch may be varied to any required nicety."

SIEMENS' ELECTRIC TELEGRAPH.

Fig. 1.

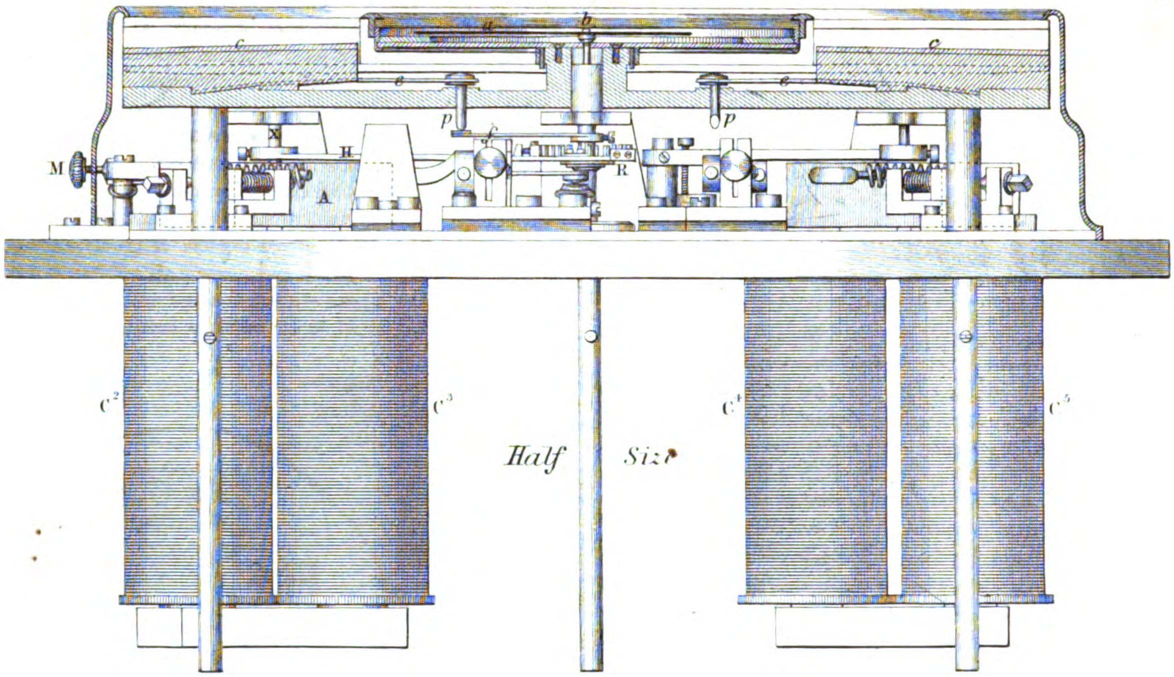
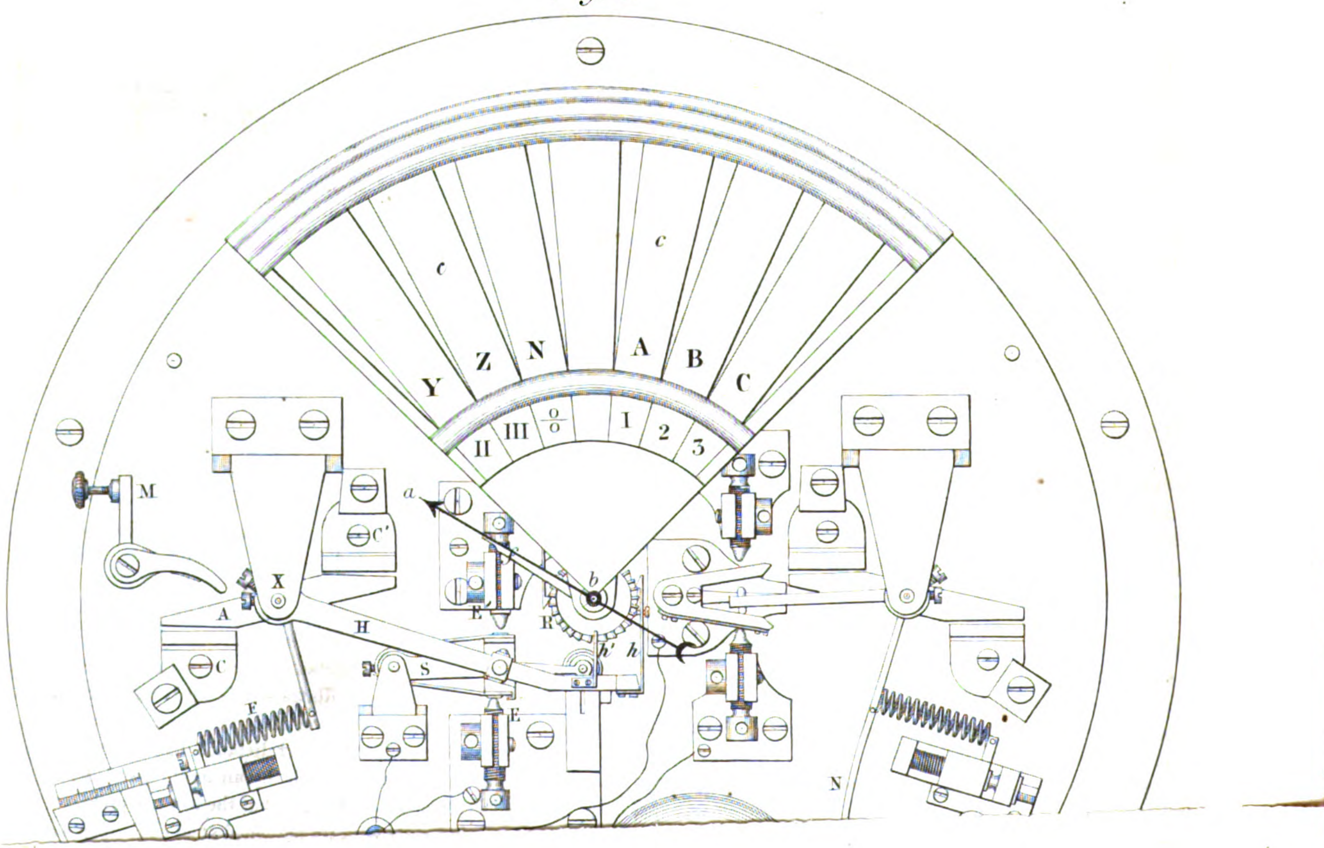


Fig. 2.



SIEMENS AND HALSKE'S ELECTRIC TELEGRAPH.

(Illustrated by Plates 96 and 97.)

Of the vast collection of modern ingenuities, placed in one mass before the world in the Great Exhibition, none, perhaps, have been more justly rewarded with that highest of Exhibition honours—a council medal—than the electric telegraph of Messrs. Siemens & Halske, of Berlin. Of this beautiful invention—otherwise known as the *Prussian State Telegraph*—we are now enabled to present our readers with the first perfect and fully-detailed account which has appeared in this country, illustrated by two elaborate engravings on the scale of half size, as drawn by us from the actual instruments shown in the Exhibition.

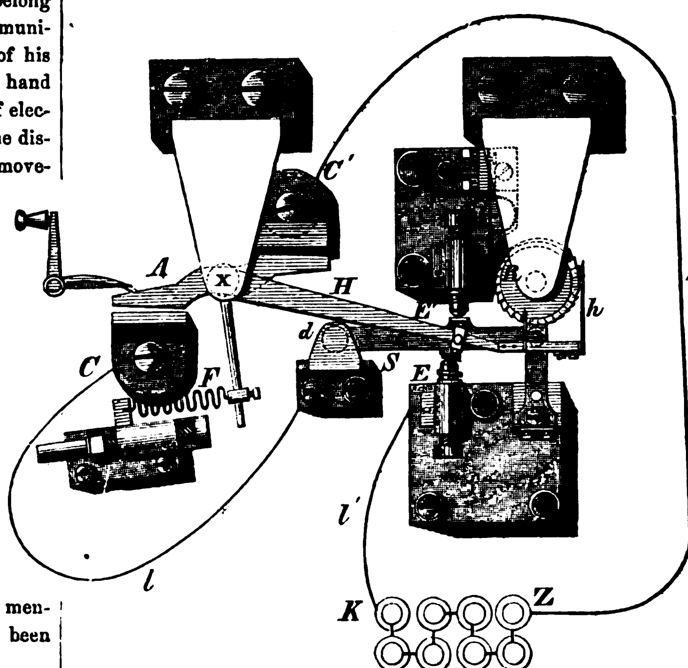
The leading principle which distinguishes this telegraph is, "that each instrument within the metallic circuit of the line-wire alternately breaks, and restores that metallic circuit by the oscillatory motion of its own armature." In all other electric telegraphs, whether they belong to the class of needle, rotatory, or printing instruments, the communicator of a message arbitrarily breaks and restores the circuit of his battery with the line-wire or wires, either by the motion of his hand directly, or through the medium of clockwork. The succession of electric currents thus produced, in exciting the electro-magnets of the distant station, causes as many deflections of a magnetic needle, or movements of a slender armature, which are the elementary signals of the message. The energy of these movements depends upon the power of the battery employed, upon the resistance, and upon the more or less perfect insulation of the line-wire. As these conditions vary, so should the speed of the communicating instrument also be varied; but this is impossible, because the communicator has no evidence of the effect which he produces. If the insulation of the line-wire is very imperfect, as it frequently is at times of heavy rains and fogs, the movement of the needle or armature, which, at the best, is but extremely feeble, unless the line is very short, will cease altogether. At other times, the electric excitement of the atmosphere prevents the working of telegraphs. The general practice with the ordinary needle-telegraph is, that the receiver of a message sends back, at the end of every word, a signal of "understand," or "not understand," which to a great extent overcomes the difficulty above mentioned; but it gives no security whether the word has really been rightly understood.

In using writing or printing telegraphs, this make-shift would be inapplicable; and herein lies, we think, the principal reason why the primitive needle-telegraph is still preferred in this country. Mr. Siemens, in adopting his principle of "self-interruption of current," seems to have conquered this fundamental difficulty; because, in his telegraph, the electric current is the only motive power employed, not excepting even in the heavy mechanism of his type-printing telegraph, and the rate of working is always proportional to that power. This advantage will become more apparent to those of our readers who have only paid occasional attention to the subject of telegraphs, in making a comparison, on the one hand, between the generality of electric telegraphs and the original steam-engine of Savery and Newcomen, where a boy watched the motion of the working-piston, to reverse the valves the moment it had achieved its stroke; and, on the other hand, between Siemens' telegraph and the modern steam-engine, with its self-acting slide-valve. This may seem to be a flattering comparison, but the analogy is nevertheless pretty near the truth.

We may now show how this principle has been carried out by the mechanical genius of Mr. Halske. Our plate 96 represents Siemens and Halske's indicating instrument, with its alarum, fig. 1 being a sectional elevation, and fig. 2 a plan, showing partly the face, and partly the internal arrangement of the mechanism. In drawing a line perpendicularly through the centres of the views, the mechanism on the left of that line belongs to the telegraph, and that to the right—to the alarum. Both of them are worked by one and the same line-wire; and it may also be well to premise, that there exists no distinction between the communicating and receiving instrument—all the instruments within the line-wire circuit being only repetitions of the one here presented.

In looking down upon the instrument, it presents the appearance of a dial-plate, with a hand, *a*, which is fastened upon the upright spindle, *b*. The dial is surrounded by radiating keys, *c*, each bearing a letter of the alphabet, with the exception of two, which are blank, to denote the interval between words. In pressing down any one of the keys, one of a series of pins, *p*, with bevelled points, is depressed with it, but is raised again, on releasing the key, by one of a series of springs, *e*. The upright spindle, *b*, carries a ratchet-wheel, R, cut with the same number of teeth

Fig. 3.



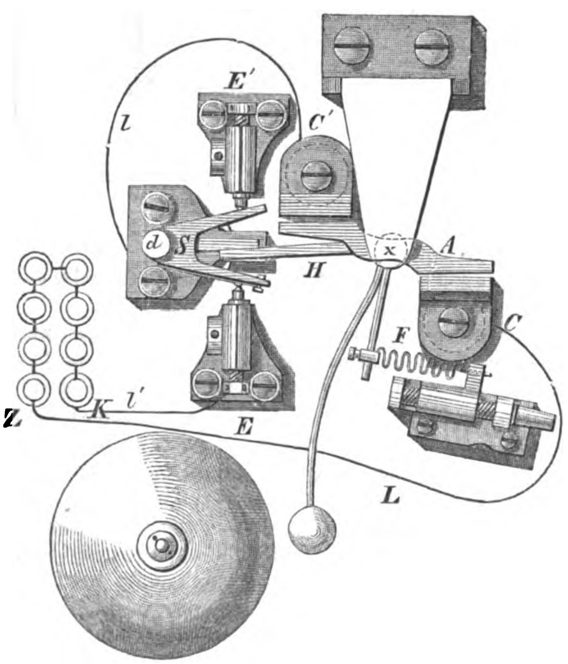
as there are keys and pins, and immediately above the wheel is an arm, *f*, which coincides in its angular position with the hand, *a*.

The mechanism employed to impart motion to the ratchet-wheel is represented in detail by the accompanying wood-engraving, fig. 3. C C′, are the poles of a horse-shoe electro-magnet, the coils of which are visible in fig. 1, marked C^2, C^3. An armature, A, is at liberty to oscillate between them on its axis, X. A lever, H, is fastened to the same axis, with its spring-catch, *h*, and a detent, *h′*, to work into the ratchet-wheel, R. An adjustable spiral spring, F, has a constant tendency to draw the armature, A, away from the poles of the electro-magnet; and immediately below the lever, H, is another metallic lever, S, with two upright flanges, between which the lever, H, oscillates—striking towards the end of its motions alternately against the one and the other, thereby moving the lever, S, through an exceedingly short distance, turning on its centre, *d*, its motion being limited on one side by an agate point, E′, and on the other by a metallic point, E. The point of the lever, S, presses downward by its elasticity, and rests with its hardened steel edge upon a stationary prism of agate, tending to slide down on the one side or the other, and to maintain the flanges of the lever, S, in firm contact alternately with the screw point, E and E′. K Z, denotes the battery; L, the line-wire; and *l* and *l′*, the connecting wires. The circuit being closed, the electric current proceeds from the battery at Z, through the line-wire, L, and

through the coils of the horse-shoe magnet, c^2, c^3, and hence through the wire, l, and the insulated lever, S, to the metallic point, E, and thence back to the battery at K, through the wire, l. The current, in exciting the electro-magnet, c^2, c^3, causes the armature, A, to be attracted, and therefore the lever, H, to move until it strikes against the upright flange of the lever, S, and knocks it against the insulated screw point, E. The spring-catch of the lever, H, has, at the same time, grasped another tooth of the ratchet-wheel, R. The electric current being now broken at E, the magnetic power ceases, and the spring, F, predominating, effects the return stroke of the lever, H. Towards the end of its motion, it strikes the contact lever, S, against the metallic point, E, whereby the electric current is again established, and the armature, A, is again attracted, and so on. It is evident that each oscillation of the armature causes the ratchet-wheel, R, to turn through the breadth of one tooth, and the hand on the dial to advance from one letter to the other.

Supposing now that the line-wire, L, passed through several instruments of the same description, then, the place of contact being established in each of them, the current will pass; and supposing the resisting springs, F, to be nearly equally adjusted, all the armatures will be simultaneously attracted. Each instrument then breaks the circuit separately, and its armature recedes to re-establish it. No current, however, can pass until all the instruments have fully accomplished this movement, and completed the circuit. Another simultaneous motion of the armatures will then take place, and it is evident that the hands on the different dials must move in concert. These oscillations follow each other with the rapidity of 25 in a second. In pressing down a key in one of the instruments, the lever, f, in its progress will be arrested by the depressed pin, p, preventing the lever, H, from accomplishing its return-stroke. The remaining instruments re-establish their contacts; but the

Fig. 4.



whole circuit being not yet completed, they must stop until the depressed key is released. If now the hands of the different instruments are made to point to the same letter, in the first instance they will stop at, and indicate the letter on the depressed key. The whole message is thus spelt in pressing down the keys, and received at one or several stations. The agreement between the position of the several hands is easily effected, it being understood that the communicator presses the blank key in the first instance, and the correspondents move the hands of their instrument up to the same sign in working their armature by a button, M. The alarum, fig. 4, which is to the right of the telegraph, is also worked by the electric force only, and through the same line-wire. Its object is to call the attention of the attendant at a distant station while the telegraphs are at rest. In turning the arm of a commutator from the position of "rest" to that of "telegraph," the current of the battery passes through the coils of the alarum magnet, c^4, c^5, at the distant station. The mechanism of this alarum is quite similar to that of the telegraph, only instead of the arm, H, in the latter, the armature here gives motion to a bell-hammer, N, which continues to strike until the commutator arm of the other station or stations is moved to "telegraph," when the hands on the dials begin to move round.

The indicating telegraph is complete in itself, and may be used singly or in conjunction with a printing instrument, called the *Secretary*, which prints the whole correspondence at each station in ordinary type.

The printing apparatus does not necessarily accompany the indicating apparatus just described. Its office is to record, in common type, the correspondence which has been carried on, and this at both stations; so that the sender of a message retains a fac-simile of it—which is as faithful a record as the press copy of a letter. The telegraph is thus rendered a safe vehicle for commercial transactions. The mechanism of the printing apparatus, or "secretary," is similar to that of the indicator. In plate 97, fig. 1 is a sectional elevation, and fig. 2 a plan of the secretary, without the printing cylinder.

A and B are two electro-magnets, between the poles whereof the armature, C, oscillates. The upright spindle, D, of the armature carries a lever, E, which is armed with a spring-catch and detent, to work into the ratchet-wheel, R. This ratchet-wheel has the same number of teeth as that of the indicating instrument, but carries, instead of the hand, a type-wheel, T, which consists of radiating springs, carrying each a letter of the alphabet, with the exception of two, which are left blank, to denote the space between words. A contact lever, S, is arranged in the same way as in the indicator, only both the points F and F' are metallic—the one to establish the current of the line-wire to pass through the coils, A, and the other to establish a local current through the coils, B, which serves to effect the return-stroke of the armature. By this arrangement, the office of the spring, G, is superseded, and it is only retained for the purpose of adjustment, the advantage being, that the power necessary to attract the armature (that is, the current of the line-wire) is much diminished. A blackened printing cylinder is placed immediately above the type-wheel, between the fixed centres, H and H', with a strip of paper intervening between the two. If now the type immediately below the roller were struck upwards by a hammer, it would imprint itself upon the strip of paper in pressing it against the blackened roller. This blow is struck by the arm, I, of an additional electro-magnet, K, at any moment when the type-wheel is arrested by the pressing down of a key of the indicating instrument. The arrangement is this:—

A bell-crank lever, L, takes two positions—one against the insulated point, l, and the other against the metallic point, l'. If in the latter position, the electric current of a local battery and the electro-magnet, K, is established, provided it is not broken at the point, F, where it also has to pass through. This current has the effect of striking a blow of the hammer, I; but the electro-magnet, K, and its armature being very heavy, as compared to the magnet, A and B, it is necessary that the current should pass through a certain, though very small period of time before it can take effect. While the type-wheel is working round, the contact at l' remains closed, but that at F opens and closes in such rapid succession, that the currents take no effect upon the magnet, K. If, however, a key of the indicating apparatus is pressed down, the type-wheel will stop, and the contact at F remains closed. An instant of time later, the electro-magnet, K, attracts its armature, and imprints the letter upon the

SIEMENS' ELECTRIC TELEGRAPH.

Fig. 1.

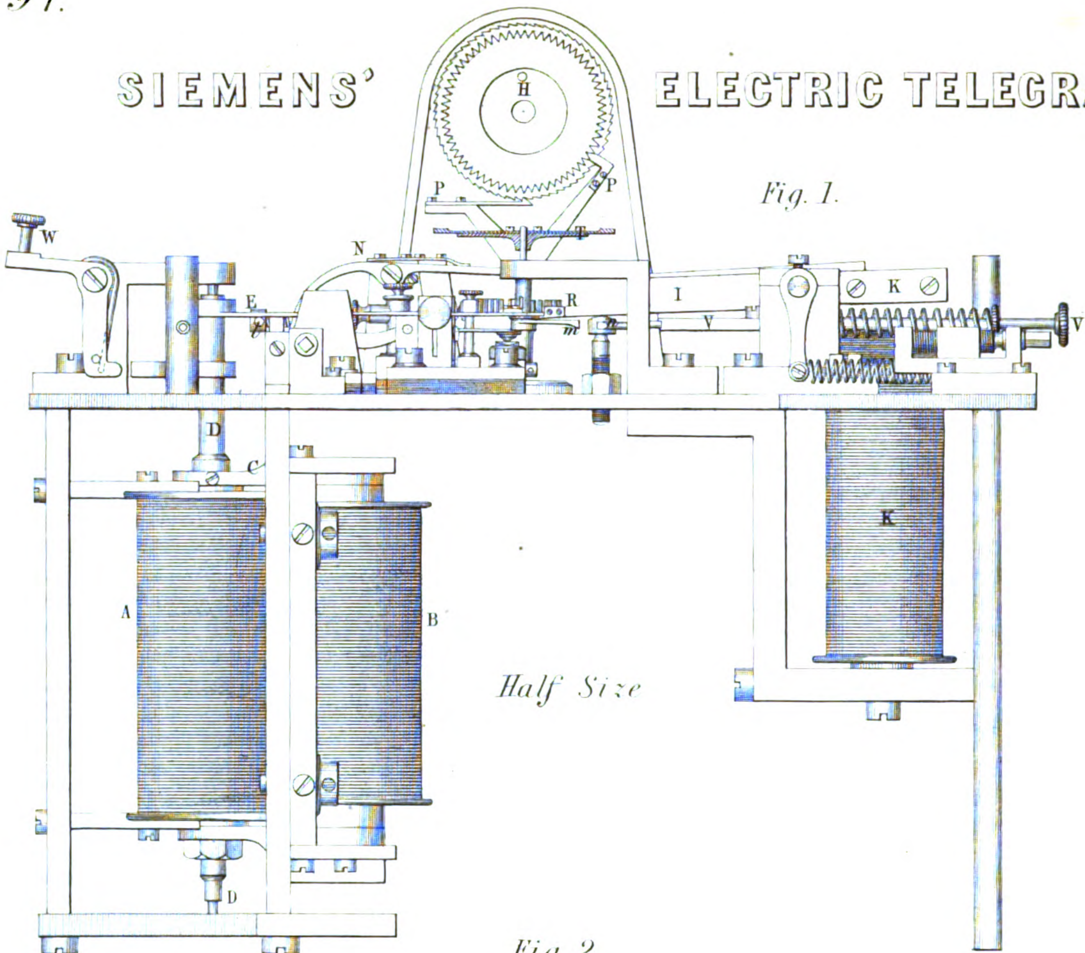
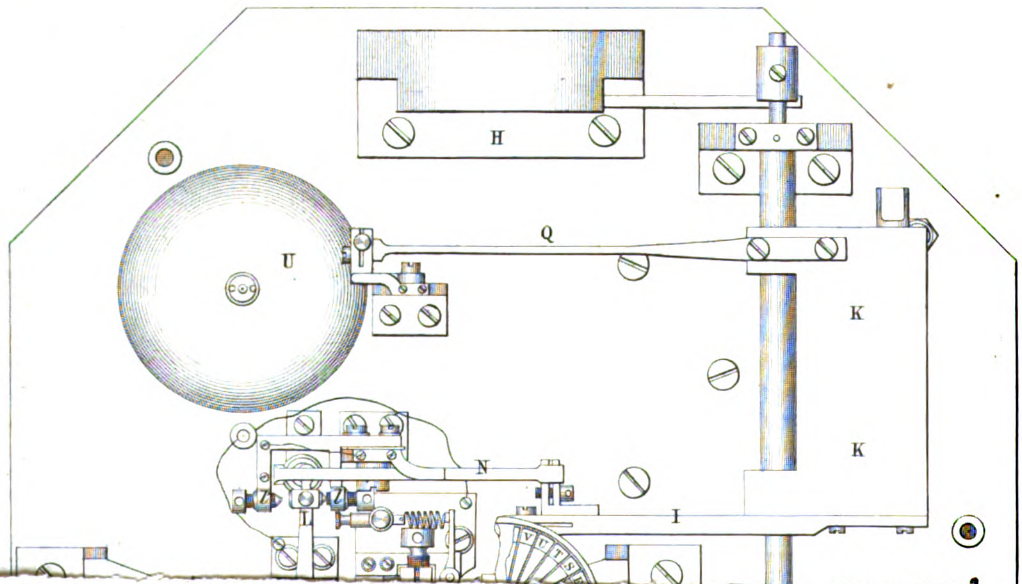


Fig. 2.



strip of paper. In striking the blow, the arm, I, strikes the curved lever, N, and that in its turn the bell-crank lever, L, breaking the circuit at *l*, and allowing the hammer to fall back directly, to allow the type-wheel to proceed in its course. The falling back of the hammer, I, and the armature of the magnet, K, is insured by a spring, O. Each movement of this armature causes the printing roller and paper to advance through the breadth of one letter, by the escape-movement, P. By means of an internal screw, the blackened roller also advances in the direction of its axis, in order to present its whole surface gradually to the type. If the elastic segment of the type-wheel is a blank, carrying no type, then the hammer is not checked, and a lever, Q, touches the bell, U, and announces to the operator, at the end of every word, that the position of the type-wheel coincides with that of the hand. The instant after the blow is struck, the type-wheel may proceed in its course, and the first oscillation of the lever, E, moves the bell-crank lever, L, back against the contact, *l*, to put the printing magnet, K, again in condition to act. The position of the type-wheel must, in the first instance, be adjusted to that of the hand on the indicating instrument, which is effected by first pressing the button, which arrests the type-wheel in a certain position by the arm, *m*, running against the point, *n*, of the button, V. If the hand on the printer does not stop upon the same letter, either the type-wheel or hand is moved round, by repeatedly pressing the button, W. The adjustment being once made, the printer requires no more attention on the part of the operator, who will find at the end of his discourse his whole conversation recorded in type. The end of a message is always recorded by the letter P; and if that has printed P, it is morally certain that every letter in the whole message must correspond, and may be *guaranteed* by the Telegraph Company,—an advantage which will be very apparent to a commercial community, when it is remembered that existing companies in this country do not hold themselves in any way liable even for their own blunders. It has been stated above, that, in using this telegraph, the perfect insulation of the line-wire is not essential, or would even be a disadvantage, inasmuch as the current of bad insulation is equally a working power for the instrument. This will be understood by closely examining the action of the self-interruption of the current. Each instrument breaks all connection with the line-wire at the end of its stroke, and its armature is therefore at perfect liberty to recede, however much electric excitement may still remain in the line-wire. Having completed its return-stroke, it re-establishes that connection; but the armature being now at its greatest distance from the poles of the magnet, it requires the maximum effort to move it. The current of bad insulation may nearly reach that maximum, and the armature cannot move until the instrument has also completed its return-stroke, and established the circuit of the line-wire, which, however small, makes up the deficiency, and works the instruments.

Advantage has been taken of the short duration of the electric impulses which work the telegraphs, to transmit other descriptions of signals, such as ringing alarums, through the same line-wire requiring a current of longer duration.

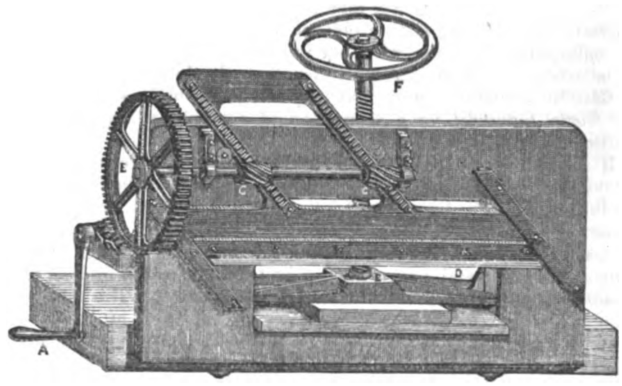
On the line from Berlin to Hamburg, for instance, the same line-wire through which the messages are sent, announces the progress of each train, by ringing upwards of 300 large alarums, placed along the line at such distances, that the signal is heard at every point of the line.

One of the most important features of Siemens' telegraph is, that the line-wire, instead of being carried on poles, is laid two feet below the surface of the ground, being securely coated with vulcanized gutta percha. Mr. Siemens proposed this method of insulation to the Prussian government as early as the year 1846, who, in 1847, authorised him to lay down an experimental line, and in 1848 adopted it generally; and other states have, one after another, followed her example. The lines in Prussia consist of only one line-wire, which is chiefly occupied by the government, although private messages are also transmitted.

Having established upwards of 3000 miles of his telegraph, Mr. Siemens is at present in Russia, to stretch a similar network over the wide expanses of that empire.

During the last month, the question of the telegraphs has been fully discussed before the Institution of Civil Engineers, in which Mr. C. W. Siemens has taken an active part on behalf of his brother's system, against the objections raised by Mr. Bidder and others. The superiority of the underground system was admitted on all hands; but the supporters of the system adopted in this country urged its greater expense as an objection to it. Mr. Siemens proved that a mile of underground telegraph, as laid in Prussia, did not exceed the cost of a mile of overground and needle telegraph in this country, instruments and all included, considering that in Prussia only one, and in this country two line-wires were required. In reply to this, it was asserted that the needle telegraph was worked more rapidly than the Prussian telegraph. This Mr. Siemens admitted, but asserted that he secured *certainty*, instead of the uncertainty attending the working of the needle telegraph, and which obliged the companies to recommend to their customers to send all important messages twice, without giving them any guarantee of correct transmission. The rapidity of Siemens' and Halske's instruments is from 50 to 60 revolutions of the hand and type-wheel per minute. The letters most frequently occurring being repeated on the dial, it follows that, on each revolution, three letters will be found, giving a maximum speed of 150 to 180 letters per minute, not reckoning the time for stopping. An experienced operator will transmit upwards of 120 letters a minute; although in Prussia, where operators are pensioned non-commissioned officers, who inscribe every letter in their register as it is sent, the average speed does not exceed 60 letters per minute. The needle telegraph gives about 30 words per minute, being worked always at its highest speed, and requiring twice the amount of line-wire and attendance.

ENGRAVED PHOTOGRAPHS—BOTTIER'S PAPER-CUTTING MACHINE—COLT'S "REVOLVER."



[Engraved from a Collodion Film transferred to the Wood.]

It is now some time since we threw out an idea as to the prospective advantages of bringing the photographic process into more immediate connection with the engraver's art, and pointed to the more than probable chance of fitting it for the part of the engraver's draughtsman, in actually pencilling out the lines for the wood graver, the etching needle, or the burin. Considered in relation to engraving directly through the photographs themselves on copper-plates, for the purpose of producing large plate engravings, such as are to be found interspersed throughout our own pages, we have, so far, seen no reason for a change of opinion upon the practical difficulties surrounding the project. We have, however, more especially contemplated its fitness for the smaller and otherwise more manageable work of the wood-engraver; and we can now point to the engraving which illustrates this article, as being a further illustration of the soundness of our earlier views.

We may be wrong—and we are ready and willing to be set right if we are so—but we believe the annexed engraving of "M. Bottier's Paper-Cutting Machine" to be the first published example of this branch of the economics of the atelier. We believe it to be the first engraving which has been produced after the "pencillings of light." Our first

theoretical notion, seeing the then apparent impossibility of engraving an actual daguerreotype plate, was to take the photographic picture on tissue paper, and lay this down on the plate or wood block, and engrave the design through it. Then we hit upon the plan of silverizing the wood block, placing it in the camera for the image, and finally engraving it direct. This project has not yet been realized, although the recent discovery of albumenized and collodionized glass has brought us within one stage of its accomplishment. At our suggestion, Mr. Urie, the artist to whom has been intrusted the execution of the whole of the wood engravings given in this *Journal*, turned his attention to these views of the subject. After long and careful experiments, he seized upon the collodion system as best suited for his purpose, and his success with it is best evidenced in the perspective figure of the machine to which we have already referred.

After obtaining the picture upon the collodion coating in the usual manner, he detaches the thin collodion film from its glass base, and lays it on the prepared wood block, just as we had previously proposed to do with the paper image. The engraver then engraves through the film, as if he were treating an actual drawing upon the wood surface.

It is obvious that the whole process, more especially the transfer of the pictorial film from its original foundation to the block, is a matter involving excessive nicety of manipulation. The operator proceeds by floating off the film in water, by placing the glass plate horizontally therein, and with the picture upwards, assisting the dislodgment of the film, when necessary, by slight mechanical action. Then, the wood block having its surface previously prepared with white of egg and lamp-black—the darkening being necessary to throw out the picture from its translucent ground—the film is carefully laid upon the block; the white of egg having sufficient adhesive power to hold it firmly down. At first, the very obvious difficulty of the peeling off, or disintegration of the film, opposed the efforts of the engraver in his subsequent treatment of the block; but the brittleness has been overcome by a slight wash of varnish.

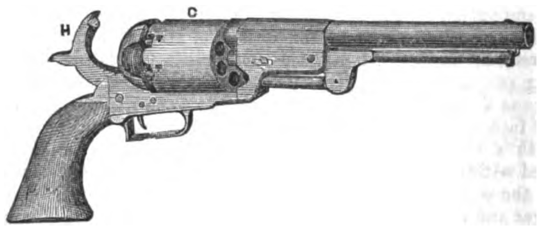
Engravings produced in this way are light-drawn pictures indeed. In his execution of them, the engraver is freed from the mannerisms or imperfections of the artist or mechanical draughtsman—escaping, on the one hand, the dangers of the lack of "life," or the missing of expression; and, on the other, avoiding all inconvenience from chance, error, or neglect.

We are now more than ever inclined to think that the time is approaching when the engraver may produce his own "sun pictures" of all external views of existing objects, directly on his blocks—reducing or enlarging his scale with all imaginable facility and accuracy. What we have shown is a great step towards this end—of *its* powers of faithful rendering, our readers may satisfy themselves, by consulting *Le Genie Industriel*, for a comparison of our reduced figure, with M. Bottier's original drawing.

If M. Bottier will pardon us for dallying so long over the introduction of his ingenious machine, we will now give some explanation of the sliding cut which he has adopted for severing large masses of compressed paper, as required by the papermaker or bookbinder. The apparatus is carried upon a heavy base of wood or stone, from which springs a strong vertical metal frame, having bolted to one side of it a pair of inclined parallel guides for the knife or cutter action. The mechanism is actuated by the winch, A, a pinion on the shaft of which gears with, and actuates a spur-wheel, B, on the overhanging end of a horizontal shaft, carrying two obliquely toothed or spiral pinions, C, similar to the screw pinions used in some classes of textile mechanism, for driving rows of spindles instead of skew-bevels. But these pinions have an essentially different action, for they gear with two inclined racks, instead of with corresponding revolving teeth. These racks are bolted to a stout frame-piece cast on the upper edge of the knife-slide, and are set at the same angle as the end knife-guides, which angle is of course selected as affording the most favourable draw-cutting action consistent with convenience of movement. The cutter or knife, B, is bolted by a side holding-slip to the lower edge of the knife-slide, so as to be carried down with it to the pile of paper held down upon the cutting table beneath, by the compressing plate, E. This plate slides at each end upon vertical guides formed on the inner sides of the framing, where it is cut away for the purpose. The pressure is given by the hand-wheel, F, fast on the upper end of a vertical screw. As the spiral pinions, C, are driven round by the wheel and pinion driving gear, each inclined tooth of the racks fits to the angle of the corresponding pinion tooth as it comes round, and the racks being guided by antifriction side-pulleys, as well as by the fixed end guides, descend at their adjusted angle to the cut. The cutting edge of the knife being horizontal, it follows that this movement gives a clean, even, and effective cut. The machine has few working parts, and is decidedly the best we have ever seen.

In the interval of writing and printing the present paper, Mr. Urie has succeeded in making daylight his "draughtsman" on the wood. The little figure of Colt's "revolver," or "repeating pistol," given below, has been reduced directly on the wood, in the camera, from a larger sketch of Colonel Colt's. The history of the operator's course of procedure may be summed up in few words. He first tried a coating of ordinary printers' ink for the blackened coating of the wood, varnishing this over with white wax, which was finally covered with the collodion film. This was a failure, from the mingling of the collodion with the wax, and the camera produced an image which shortly left a mere white ground. The difficulty now was, how to procure a good intermediate varnish, and mastic, shell-lac, and copal, were all successively tried and laid aside. Then, in retracing the process, the printers' ink was discarded, and a mixture of lampblack and white of egg substituted as the ground, with a naphtha solution of gutta-percha as a varnish beneath the collodion.

But the best results have been obtained by drying on a coating of lampblack and white of egg, and varnishing this over with a coat of pure white of egg alone before laying on the collodion. The accompanying sketch of the pistol was so produced. After collodionizing the wood, it is dipped into nitrate of silver, and placed at once in the camera,



[Engraved from a collodion photograph taken directly on the wood.]

the picture being subsequently developed by dipping in sulphate of iron and nitric acid, washed in pure water, and finally fixed with hypo-sulphite of soda, just as in the process given by our correspondent "H. R." at page 209 of our 4th volume. To preserve the picture, a final coat of mastic varnish is laid on.

The Exhibition has long since made known the peculiarities of the destructive "revolver," and our figure needs little verbal explanation. The cylinder, C, containing the charges, revolves round a centre at the breech of the pistol, the cylinder being, in fact, a reduplication of breeches. In loading, the hammer, H, is drawn back to the half notch, which movement permits the free rotation of the cylinder, when each chamber may be charged with powder. The balls, without wadding or patch, are put one at a time upon the mouths of the chambers, turned under the rammer, and forced down with the lever below the mouth of the chamber. This is repeated until all the chambers are loaded. Percussion caps are then placed on the tubes, when, by drawing back the hammer to the full catch, the arm is in condition for a discharge by pulling the trigger; a repetition of the same motion produces the like results. To carry the arms safely when loaded, the hammer must be let down on one of the pins between each tube on the end of the cylinder.

DREDGING MACHINE FOR THE PORT OF AYR.

The navigation of the Clyde, as a deep-sea channel, dates from 1824, when steam-dredging was commenced in that river. Since that time, its dredgers, by successive and important improvements, have gained a notoriety which their power, design, and economy justly merit; and we have only to point to the machines in the other Clyde ports, and elsewhere—machines, by the way, intended to be improvements on their predecessors at Glasgow—as another "modern instance" of the "wise saw," that a "good copy is better than a bad original."

Looking to and taking warning from these facts, the Trustees of the Port of Ayr, finding that the deepening-machine which had so long cleansed the harbour, and removed the bar at the mouth of the river Ayr, was unfit for their purpose, as well as comparatively expensive to work, from the combined effects of age and fundamental defects, came to the resolution of obtaining a design for one, which, while it would combine such improvements as increased experience in the manufacture and working of dredgers must have suggested, would still retain as its basis the general features and construction of the Clyde machines. In accordance with this decision, a design has been prepared by Mr. T. Ormiston, Assistant Engineer on the Clyde Navigation; and as it has been very carefully got up, and presents several important practical sugges-

tions, we present our readers with the specification, and our general remarks thereon.

The principal points in which Mr. Ormiston's design differs from the dredgers in common use are the following:—First, The large cogged-wheel being placed below the crank-shaft, the main framing is inclined much more nearly in the direction of the thrust of the buckets, a force which has generally caused the framing to heel over the stern a few inches; the posts supporting the framing are very low, and the consequence will be a considerable reduction in the amount of vibration attendant on the working of the vessel; the shears are of such a height that the bucket-frame may be lifted above the main framing, giving ample room to make any repairs on the buckets or chain, put in new pins and links, &c.; the lowness of the framing gives a comparatively small wind surface—a matter of much consequence in exposed ports—and the lowness of the centre of gravity gives greater stability. Second, The stern-crab is worked by the engine; and, Third, The stern-chain being led through a long hawse, and passing out under the level of the sand barge, the vessel cannot only work closer to her stern anchor, but the saving in the punts' bilges is very considerable, especially in those places where there is much sea on.

The present dredger on the Ayr was old when purchased by the trustees; and during the fifteen years which it has been in their possession, the repairs required by decay of the hull have been almost nominal, and it still remains sound and in good condition. This fact, coupled with a saving of perhaps £200, induced the trustees to decide in favour of timber as a material for the hull—a decision, the wisdom of which, even in the face of these reasons, may reasonably be questioned.

With a view to prevent *hogging*, the vessel abaft the well-head is trussed with two-inch iron rods. The sides are ceiled for some distance abaft the well-head, after which oak diagonals are fixed between the stringer and keelson, to take the strain off the side planking, and extra keelsons are laid at the waist, the weakest part of the vessel, in consequence of its being here cut up by the well. A satisfactory connection of the two sterns is also effected, by heavy scantlings passing right athwart-ships, firmly bolted together and to the stern.

Experience having proved that yellow pine is the most profitable description of planking for decks, it has been here adopted, both on account of its cheapness at first, and greater durability; and at proper intervals bolts are introduced alongside the deck beams, to prevent the sides being bulged out either by excessive or repeated caulking of the deck planks.

The motive power is a condensing steam-engine of the side-lever description, of a nominal power of twenty horses, having a cylinder twenty-six inches diameter, and thirty-inch stroke, making forty strokes per minute. The steam is used at from three to four lbs. on the square inch, generated in a flue boiler of the following proportions, which have been found to give ample steam and be easily fired:—

Horizontal water surface, 85 square feet	4·25 sq. ft.	per H.P.
Effective heating surface (roofs and half of sides), 170 sq. ft.	8·50 "	"
Steam space, 125 cubic feet	6·25 cub. ft.	"
Water space, 135 cubic feet	6·75 "	"
Fire-grate, 16 square feet	0·80 sq. ft.	"
Coals used in keeping up the steam, 12 lbs. per square foot of fire-grate	10·00 lbs. per hr.	"

Of the four movements in the machine, we shall first describe the most important, namely, that for working the buckets, by far the greatest proportion of power being expended in digging. A bevel pinion on the crank-shaft gears with a cogged-wheel on the lower end of the inclined shafting, on the upper end of which is keyed a bevel pinion, which drives the wheel on the tumbler-shaft. The notation of this gearing gives the following results; and we may here state that the speeds given in this paper have been found, after a long and expensive experience, to be the most suitable, and may be relied on for the ordinary description of work:—

$$\frac{91 \times 72}{39\frac{1}{4} \times 27} = 6{\cdot}18 \text{ mechanical advantage of upper tumbler.}$$

$$\frac{40}{6{\cdot}18} \times 2 = 12{\cdot}94, \text{ say 13 buckets discharged per minute.}$$

$12{\cdot}94 \times 22$ in. length of link $\times$ 2 links per bucket $= 47{\cdot}45$ feet per min. of bucket chain.

30″ dia. of crank circle $\div$ 31·5 dia. of circle described by upper tumbler $\times\ 6{\cdot}18 = 5{\cdot}88$ ratio of effective point of upper tumbler to 1 at engine $\times$ 19 horse power (1 being deducted for working bow-crab) $=$ 111·72 nominal horse power, minus the friction, tugging at the bucket-chain.

The gearing for hoisting the bucket-frame is arranged according to the following description:—A mitre wheel on the crank-shaft communicates motion to a vertical shaft, from which the power is transmitted through a bevel wheel and pinion to a horizontal shaft, carrying a pinion, which drives a bevel wheel on a shaft having a shifting clutch, which can be thrown in or out of gear with the barrel by a handle on deck. A friction-wheel and strap is attached to the barrel-shaft, and holds the frame suspended in any required position by means of a 56 lb. weight attached to the lever fixed on the strap; and as this lever is alongside the clutch-handle, so soon as the clutch is thrown into gear, the weight is taken off the friction lever, and the frame is allowed to rise freely. We give some of the speeds of this gearing below:—

$\dfrac{24 \times 62}{14 \times 14} = 7{\cdot}5$ to 1 of engine, and $\dfrac{40}{7{\cdot}5} = 5{\cdot}33$ revolutions of barrel per minute.

Barrel $19\frac{1}{2}$ in. + chain $2\frac{1}{2}$ in. = dia. 22 in. = 69 in. circumference; and since there are 2 sheaves in lower block, $\dfrac{5{\cdot}33 \times 69 \text{ in.}}{4} = 7{\cdot}65$ feet of lift per minute $\times$ half weight of frame, 18,032 pounds, and divided by 33,000, gives 4·18 horse power exerted in raising the frame.

To remove the shock in starting, and to prevent breakage as much as possible, from the buckets or frame coming in contact with roots, old anchors, timber, &c., a friction connection is made in the largest wheels of the hoisting and digging gearing, with the screws tightened so as to slip when the strain becomes unsafe. In the forward and stern motions, this purpose is sufficiently served by the slipping of the belts.

On the first introduction of steam dredging-machines, a capstan, worked by four men, was used to drag the vessel ahead. A crab-winch was afterwards substituted for this purpose, still worked, however, by the same number of hands; and it was not until 1840, that the engine itself was applied to this purpose. This application has been quite successful, at once relieving the men from a most laborious occupation, and effecting a saving of 25 per cent. in the wages of the crew, while the first cost of the arrangement did not exceed £80. As different sorts of material require that the vessel should go ahead at different speeds, the motion is communicated by a belt from the crank-shaft, driving a set of change wheels and pinions of the following proportions:—

$$\left.\begin{array}{ll} \text{1st.} & \dfrac{40 \times 14}{18} = 31{\cdot}11 \\ \text{2d.} & \dfrac{40 \times 10}{22} = 18{\cdot}18 \\ \text{3d.} & \dfrac{40 \times 6}{26} = 9{\cdot}23 \end{array}\right\} \text{revolutions per minute of power-shaft of crab.}$$

The bow-crab must necessarily be a strong machine, and capable of resisting the sudden shocks to which it is liable; the barrel should be well rounded to surge the chain properly, and be whelped to prevent the chain slipping, four turns on the barrel generally giving sufficient hold. An attendant takes the chain from the crab as the vessel goes on, and leaves it piled up at one side, ready to be payed-off as it again returns astern. The crab is double-powered, having wheels of the following proportions:—

$\dfrac{14 \times 24}{5 \times 5} = 13{\cdot}44$; barrel 9 in., and chain 3 in., = 12 in. dia., = 37·70 in. circumference.

1st. $\dfrac{37{\cdot}7 \times 31{\cdot}11}{13{\cdot}44} =$ 7 feet 3 in. ahead per minute, quickest motion; for sludge.

2d. $\dfrac{37{\cdot}7 \times 18{\cdot}18}{13{\cdot}44} =$ 4 feet 3 in. ahead per minute, intermediate speed; coarse sand.

3d. $\dfrac{37{\cdot}7 \times 9{\cdot}23}{13{\cdot}44} =$ 2 feet 2 in. ahead per minute, slowest speed; fine sand, stone, clay, &c.

This winch may be worked by hand, its power being represented in the following notation, the radius of the handles being 16 in., and the semi-diameter of the barrel measuring to the centre of the chain wound on it 6 in.:—

$\dfrac{32 \times 14 \times 12}{5 \times 5 \times 6} = 35{\cdot}84$ mechanical advantage of crab, $\times$ 4 men at 25 lbs. each, = 3584 pounds, fully a ton and a half.

The motion is conveyed to the stern-crab by a belt from the crank-shaft to a fast-and-loose pulley on the end of a line of small shafting, leading from the engine-house aft; its rate is $\dfrac{40 \times 30}{12} = 100$ revolu-

tions per minute × circumference of barrel and chain 30 in. = 250 feet per minute.

We append a few details as to the cost of working such a machine as this is, at the present rate of wages and stores in Scotland. The cost of a week's work would be between £12 and £13:—

1	Master,		£1 4 0
1	Engineer,		1 10 0
1	Fireman and Cook		0 15 0
4	Deck hands (1 at bow-crab, 1 at bucket-well. and 2 at punts), @ 15s.,		3 0 0
1	Watchman for punts at night,		0 12 0
3	Puntmen removing punts to and bringing them from moorings, @ 15s.,		2 5 0
11	Wages,		£9 6 0
	Coals, 9 tons, @ 6s.,	£2 14 0	
	Oils, ropes, and tallow,	0 6 0	
	Stores,		3 0 0
	Cost of working Dredger per week,		£12 6 0

During which time it will lift about 3000 cubic yards of coarse sand, at 26 cwt. per yard = 3900 tons, being rather less than one penny per yard for dredging only, to which must be added the cost of removal and deposition, depreciation of machinery and vessel. In this calculation we have supposed the dredging to continue for a whole day, without other interruption than the usual time for taking meals; no detention for want of punts, nor deep water, breakage of machinery, or shifting anchors—circumstances which, it is obvious, will frequently occur in practice—so that the sum named does not by any means represent the actual cost of dredging when distributed over any length of time. This will vary according to circumstances; so much so, that in some materials one-fourth of the above quoted quantity would not be considered a bad day's work. In similar circumstances, however, the old machine at the Ayr would not lift half the quantity, whilst it requires considerably more men, five or six men being employed in scooping the stuff from the buckets on to the punt.

The cost of this vessel would be about £3500 complete, of which the hull would cost £1200, the machinery £2150, and the stores £150. We shall give the specification of the hull next month.

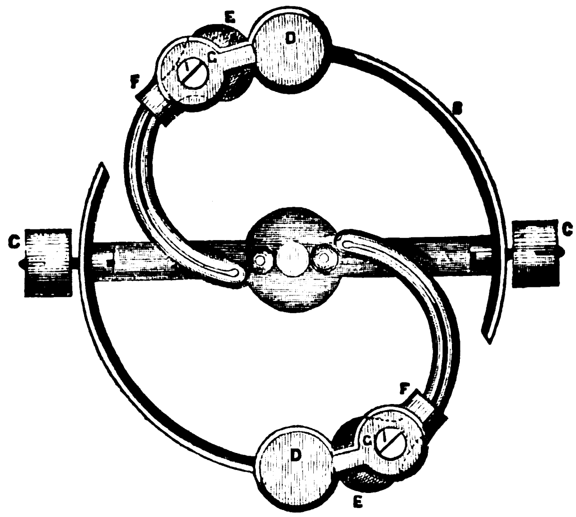
HOROLOGICAL IMPROVEMENTS—LOSEBY'S TIME-KEEPERS —GERARD'S FIELD TRANSIT INSTRUMENT.

The name of Loseby holds a conspicuous place in the ranks of English improvers of chronometers. In his latest improvements in the higher branches of horology, this maker has introduced an improvement in the compensation balance—a correction for rendering the long and short arcs of the pendulum isochronous, and an improved form of mercurial pendulum. In connection with the first of these heads, we are reminded of the undoubted fact, that, except in this point alone—the balance, the whole experience of the past half century has failed to give us any improvement upon preceding discoveries. The best chronometer which we could purchase to-morrow, would present the identical features of the time-keeper of fifty years ago, except in this one feature. We have had plenty of novelties from the combined efforts of mathematicians and practical men, but nothing more.

In the ordinary compensation balance, the acknowledged defect has always been the difficulty of getting the rate right at intermediate points of temperature, when perfectly adjusted for extreme variations, owing to the balance-spring losing elasticity at an accumulating rate over the effect due to the compound laminæ of the balance. In Loseby's chronometers, this great defect has been successfully treated by the adaptation to the balance of curved mercurial tubes, so arranged that, as the contained mercury expands by an elevation of temperature, it approaches the centre of motion at a gradually accumulating rate. Fig. 1 represents a plan of this balance; and fig. 2 is a side elevation. A, is the bar of the balance. B, B, is the compound rim of the balance. C, C, are timing screws, and D, D, are weights for adjusting the ordinary compensation. E, E, are the supplementary compensation tubes. F, F, and G, G, are fittings, for attaching the tubes to the balance. I, I, are screws connecting the parts F and G; they also admit of the supplemental compensation being adjusted, by turning the tubes in or out, so as to alter their inclination to the radii of the balance: but it has been found in practice that the tubes can always be applied by rule, so as to bring the supplemental compensation within five-tenths of a second a day throughout the whole range from 10° to 110° F.; any subsequent alteration is, therefore, seldom required. This is an important feature in a manufacturing point of view.

The difficulties met with previous to the use of mercury as a compensator, may be in part understood, on remembering that, in order to keep the same time in all temperatures, it is essentially requisite to increase the compensation at a certain rate of accumulation throughout the total range. With a sufficient motion in the old compound laminæ, and had a slight degree of friction involved no serious objection, this

Fig. 1.



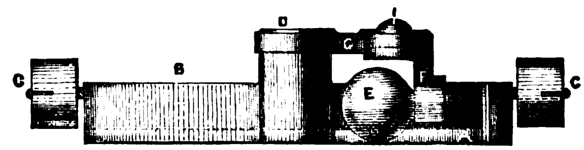


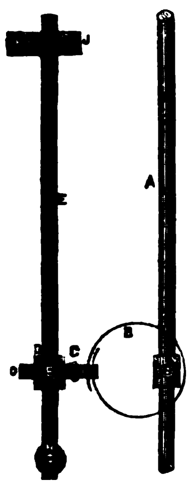
Fig. 2.

might have been easily accomplished; but when it is known that the entire motion in a large box chronometer does not exceed $\frac{1}{250}$ of an inch (about the thickness of a piece of writing-paper), from 32° to 100° Fahrenheit, and that this minute motion of the weight produces a difference in the time of 360 seconds a day, the uncertainty of any adjustment having a mechanical bearing upon the compound laminæ, or depending on a difference of ratio in the motion of the weight, is at once apparent.

According to a report of the Astronomer-Royal, upon the trial of this compensation at Greenwich, and a summary of the results of 125 chronometers tested between the years 1848 and 1851, whilst the mean error of all the others, taking the greatest difference between the greatest and the least, was 31·9 seconds, and between one week and the next 19·6 seconds,—Mr. Loseby's showed errors of only 14·4 seconds, and 5·9 seconds under corresponding circumstances. In considering the difficulty of the unequal vibrations of pendulums through long and short arcs, Huygens showed, in the middle of the 17th century, that the cycloidal swing would remedy the evil. Whilst this theory has failed in practice, it has led to the diminution of the arc, in order to restrict the vibration to that portion of the circle which approximates most closely to the cycloid. But while a smaller error in the time, due to a given change of arc, may be thus secured, it must be remembered that a variation of the force will produce a greater change in the arc itself; whilst the velocity being reduced, the pendulum will be more influenced by any disturbing cause; there can therefore be no doubt, that if the pendulum could be rendered perfectly isochronous, a longer arc might be employed with considerable advantage. Before describing how this has at length been accomplished, it may be as well to observe that the difficulty of rendering the long and short vibrations equal, has led to attempts at preventing any change in the arc itself, by the introduction of contrivances between the train of wheels and the pendulum, which are made to intercept the power, with a view of giving a uniform impulse to the pendulum under every variation of force in the train. This method, under the general term of *remontoire*, has appeared in numerous forms; but hitherto they have involved a greater complication of arrangement, with a considerable increase of wear and tear in the clock, without producing any corresponding advantage. Indeed the clock, so far as accuracy of time-keeping is concerned, has made less progress of late than the chronometer, and

may be said to have been completely at a stand-still since Grayhan's invention of the dead-beat escapement, and mercurial pendulum, which yet form the chief features of the most perfect clocks. Seeing, therefore, that a correction for arc has now been added, which will enable the clock in its simple form to achieve all that could be expected from remontoires, there appears every probability, judging from the progress during the last century, that the same construction will continue for a still longer period. The compensation for a change of arc is effected by a fine spring, arranged in such a position that the impulse which it gives to the pendulum increases at the same rate of accumulation as the increase of arc retards it; thus causing the long and short arcs to be performed in the same time. It may be here explained, that the term compensation is generally understood, in horology, to signify a correction for change of temperature, but it may be considered as applying in any case where one error is artificially created, to neutralize another that already exists.

Fig. 3.



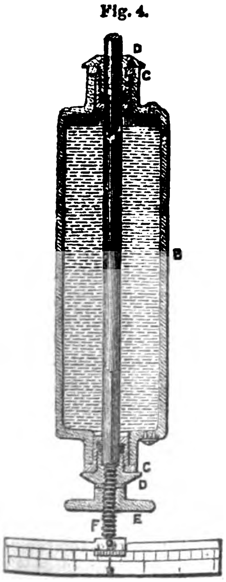
One arrangement of this plan is shown in fig. 3.

A is the pendulum rod at rest. B is the compensating spring. C is a sliding piece, in which the spring, B, is clamped by a screw, G. D is a slide on the bar, E, and it is secured in any required position by a screw, F. H is a screw for attaching the bar, E, to the pillar, I, which, with the clamp-headed pillar, J, project from the back of the clock-case—J being provided with a binding screw, K. M is a sliding piece attached to the pendulum, A, and carrying a stud, N, which, as the pendulum vibrates, draws the spring into an elliptical form.

Facility is therefore given for adjusting the compensation, as the spring can be moved higher or lower from the point of suspension, nearer or farther from the pendulum rod, and larger or smaller by drawing it through the clamp.

According to the Astronomer-Royal's opinion, this contrivance "is successful in removing a defect in clocks, which has been felt for above a century." Fig. 4 is a vertical section of Mr. Loseby's last improvement, securing a better form of the pendulum, by packing the ends of the mercury vessel. A is the pendulum rod, carrying a glass cylinder, B, containing the mercury. This cylinder has top and bottom stuffing-boxes, C, into which the plugs, D, are screwed. The regulation is effected by the nut, E, working on the screwed end, F, of the pendulum rod. To facilitate the addition or abstraction of mercury during adjustment, small screwed plugs are fitted to each end of the cylinder. The arc scale beneath has a vernier for accuracy of measurement.

Fig. 4.

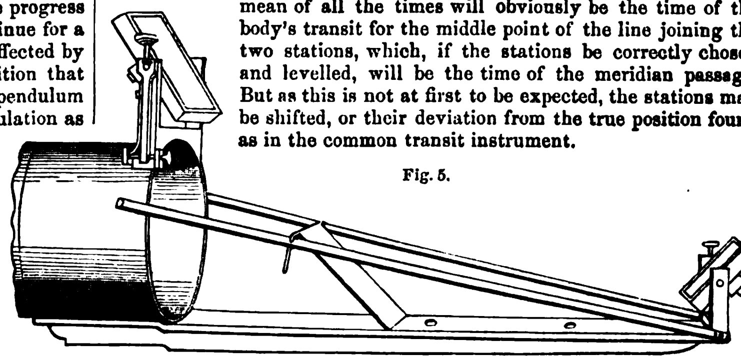


In addition to its other advantages, this pendulum is perfectly portable, without the necessity of removing the mercury, which is also preserved from oxidation.

In connection with our subject, although not falling exactly within the line of timekeepers, we may yet introduce here "a portable or field transit instrument, for finding the time on shore, and laying down meridian lines in extensive surveys." This instrument, which is the invention of Mr. Alexander Gerard, of Gordon's Hospital, Aberdeen, is represented in perspective elevation, as attached to the telescope, in fig. 5.

It consists mainly of two mirrors, arranged as in the sextant, but requires no graduated arc. The mirrors are so fixed as to measure an angle of nearly 90 degrees—say 89 or 91. Two stations are selected—the one about 100 yards nearly east or west of the other, and on the same level. A mark resembling a target, with equidistant concentric circles, is set up at one of the stations, and the instrument taken to the other, and so placed as to have the mark in the middle of the field. The telescope is then turned round its own axis till the body (sun, moon, or star) is seen by reflection in the object-glass, which will be a few minutes before it culminates. It will appear to pass the different circles on the mark in succession, and the times are to be accurately noted. The observer then takes the instrument to the second station, and an assistant sets up the mark at the first—a set of observations is then taken as before. The mean of all the times will obviously be the time of the body's transit for the middle point of the line joining the two stations, which, if the stations be correctly chosen and levelled, will be the time of the meridian passage. But as this is not at first to be expected, the stations may be shifted, or their deviation from the true position found as in the common transit instrument.

Fig. 5.



The instrument exhibited has the advantage over the common transit instrument in point of steadiness, derived from the principle of double reflection, which makes the quadrant and sextant so useful. It might be used with advantage for rating chronometers at ports where there is no observatory. For this purpose, two stands might be erected in some open space not far from the harbour, either of stone or casks filled with sand, fitted with V's for the instrument and mark. As the time could thus be found to a greater degree of accuracy than with the sextant and artificial horizon—on account of the greater magnifying power of the telescope that might be employed—a rate might be obtained in a shorter interval.

ON POISONS, THEIR PROPERTIES, EFFECTS, DETECTION, AND ANTIDOTES.

III.

Some of the preparations of antimony are highly poisonous, especially the tartrate of potash, and antimony, known in pharmacy as tartar-emetic. It has been seldom used by poisoners, its properties having been more frequently developed by chance, as when taken in mistake for cream-of-tartar or magnesia. The sulphuret of antimony—the antimony of commerce—bears some resemblance to plumbago or black-lead. According to Proust, it contains 26 per cent. of sulphur. When heated with iron filings, or carbonate of potash, it is reduced to the metallic state — the iron, or carbonate, retains the sulphur, and a button of metal, of a bluish tint, is found in the bottom of the crucible. It has a strong metallic lustre, is exceedingly brittle, and melts at a temperature a little below redness, volatilizing at a white heat. By careful management it may be obtained in rhombohedral crystals. It combines with oxygen, forming three distinct compounds; it also combines with chlorine, producing a bichloride, the formation of which is attended with combustion. It dissolves in hydrochloric and nitric acids, producing with the former a chloride, and with the latter, oxidation to antimonic acid.

The salts of antimony are of two distinct orders—antimonites and antimoniates. The combination of the first order, tartar-emetic, is the only one entitled to our consideration here. It is prepared by boiling a solution of tartrate of potash, containing oxide of antimony, when the oxide is dissolved, and evaporation of the solution yields crystals of tartar-emetic. The salts of antimony, which are soluble in water, form with sulphuretted hydrogen a very characteristic precipitate of an orange or brick-red colour, soluble in a solution of sulphuret of ammonium, and capable of precipitation again by acids. The orange precipitate, produced by sulphuretted hydrogen, or the hydrosulphurets, is easily reducible to the metallic state, by exposure to a current of hydrogen gas while heated in a glass tube. Tartar-emetic is precipitated from its solution in a white state, by sulphuric acid, alkalies, barytes, and lime.

All the preparations of antimony are easily reduced to the metallic state on an extensive scale, by calcination with charcoal and potash.

The best mode of detecting the salts of antimony, as in the case of arsenic, is by obtaining a metallic crust by means of Marsh's apparatus, which we have already explained. When the suspected liquid is transferred to the instrument, and a stain obtained, its appearance will, to a great extent, at once distinguish it from arsenic or mercury; but as the appearances are by no means uniform, they are not to be altogether

depended upon. The antimonial crust has a dark smoky appearance, whilst arsenic possesses a coppery hue, and mercury is whitish, and of globular construction, when seen through a microscope.

For essentially delicate cases, the most certain test is that recommended by Professor Guy, who treats the crust with a drop of hydrosulphuret of ammonia, in previous combination with sulphur, which adds very considerably to the delicacy of the test. Thus treated, the crust rapidly dissolves, and on evaporation, it presents an orange-red tint without any metallic appearance, sulphuret of antimony being formed, capable of solution in hydrochloric acid, but unacted on by liquid ammonia.

In the case of an arsenious crust, it will be very slightly affected by the application of hydrosulphuret of ammonia for a considerable time, always presenting a centre of metal, unless the test is frequently repeated. The margin of the crust is of a pale lemon-yellow tint, being sesquisulphuret of arsenic. Under treatment with hydrochloric acid, the crust still remains, disappearing with the touch of liquid ammonia. The eminent author of these experiments says:—"The best way to prove the delicacy of this test, is to compare a small thin stain of arsenic with a large and thick spot of antimony. It will be found to act characteristically even in this extreme case, the difference being very striking, both in point of time, and intensity of action. With this subsidiary test of hydrosulphuret of ammonia, Marsh's test resumes the superiority for delicacy, simplicity, and certainty, of which Reinsch's test threatened to deprive it." The symptoms of an over-dose of tartar-emetic, are similar to those occasioned by acids—obstinate vomitings, constriction of the throat, intoxication, cramp, and prostration of strength. The best antidotes are infusions of astringent vegetables, such as gall-nuts, oak, willow, or cinchona bark. The acids in these substances form, with the oxide of the metal, tannite and gallate of antimony, which are insoluble and inert. Tea, of course, possesses the same property, and may be given freely to excite vomiting, and, at the same time, to decompose the poison. Sulphuretted hydrogen water, or solutions of the hydrosulphurets, are also good antidotes, as they decompose the antimonial salt, and, combining with the oxide, form an insoluble sulphuret. Pure copper is of a yellowish red colour, very ductile and malleable, melting at a bright red heat, and volatilizing at a higher temperature. It is an excellent conductor of electricity and heat. It undergoes no change on exposure to a dry atmosphere; but when moist, it soon becomes covered with a green crust, principally consisting of carbonate of copper.

Oxygen combines with it in two different proportions, forming the protoxide (black oxide) and the suboxide (red oxide). A third oxide, called the superoxide, is also said to exist. This metal dissolves in boiling sulphuric acid, evolving sulphurous acid. Even dilute nitric acid readily dissolves it, whilst reduced hydrochloric or sulphuric acids scarcely act upon it. In combination with acids, it forms a series of beautiful and interesting salts, chiefly blue in colour, with the exception of two or three, which are green. All the preparations of copper are very poisonous, such as the sulphate, nitrate, chloride, acetate, arsenite (Schiele's green), and verditer. Even food cooked in foul oxidized copper vessels, and pickles tinged with green by means of this metal, are dangerous. The salts of copper are easy of detection. Ammonia, added to an aqueous solution of them, precipitates the hydrate, and, when added in excess, it is redissolved, forming an intense purplish-blue solution. Caustic potash produces a pale blue precipitate of the hydrate, which, on boiling, is changed to a blackish brown. Carbonate of potash and soda produce a pale blue precipitate, insoluble in excess; carbonate of ammonia a pale blue precipitate, soluble with deep blue colour. Ferrocyanide of potassium gives a reddish-brown precipitate of ferrocyanide of copper. Sulphuret of ammonium and sulphuretted hydrogen throw down black sulphuret of copper. If the salts of copper are dissolved in wine, malt liquors, or coffee, they are partially decomposed; but on adding a spirituous tincture of guaiacum, they are detected by the formation of a precipitate, varying in shade from a pale green to a greenish indigo. The symptoms of poisoning in this case are, amongst others, a coppery and acrid taste, dry and parched mouth and tongue, severe vomiting, constriction of the throat, and colic. M. Orfila recommends sugar as an antidote; but it is not a specific remedy, and cannot be relied on; but it may be given with advantage when dissolved in infusions of gall-nuts, tea, or coffee, as these form insoluble compounds, as in the case of the salts of antimony. The orthodox antidotes are albumen and ferrocyanide of potassium, with copious draughts of milk and water, to encourage vomiting. The latter forms, with the cupreous salts, insoluble ferrocyanide of copper, and albumen produces insoluble combinations, the rationale of which do not appear to be thoroughly understood. But there is little doubt that sulphuret of copper is formed from the presence of the sulphur contained in the albumen. The presence of unoxidized sulphur is easily detected in this natural compound. A boiled egg blackens a silver spoon, an alkaline sulphuret being separated or formed during the process of coagulation. A solution of albumen, mixed with a little caustic potash and acetate of lead, gives a precipitate of sulphurate of lead on boiling. Salts of various other metals form, with albumen, sulphurets similar to those of lead. The sulphur contained in albumen is so small in amount, that it cannot possibly neutralise the whole of the metallic poison, unless given in large quantities, when the quantity of poison taken was small—in which case it would act very favourably. The other compounds necessarily produced by the combination of the metals and albumen have not so far been analysed; therefore, we can form no very definite conclusion regarding them. They are probably compounds of the metals of the poisons, with the oxygen and phosphorus of the albumen. According to the analysis of Mulder, albumen is composed of—

Carbon,	54·84
Hydrogen,	7·09
Nitrogen,	15·88
Oxygen,	21·23
Phosphorus,	0·33
Sulphur,	0·68
	100·00

In the treatment of cases of poisoning by metallic salts, the most certain plan is to persevere with the same antidote, or at least to avoid loading the stomach with a mixture of albumen and vegetable astringents at the same time, as must be very clear from the following fact. When an infusion of galls or tannic acid is added to a solution of albumen, a copious precipitate is produced, with the formation of a new compound, different in its composition from either of the substances producing it; and, therefore, the desired effect of both antidotes will be materially, if not totally, destroyed. In one of the London hospitals, a case of poisoning by sulphate of copper was successfully treated with stimulants. The patient was a female of about 36 years of age, and the following mixture was given to her:—R. Vin. rubri ℥iv., tinc. cinnam. ʒij., syrup ℥ss. After four days' treatment, the woman was dismissed, cured. The copper colouring of green tea and pickles may be detected, by treating the suspected articles with dilute liquid ammonia in a test glass. With the presence of the smallest quantity of copper, the ammonia assumes a fine blue colour, ammoniaret of copper being formed.

We shall conclude our examination of the metallic poisons in our next paper, with some notes on the various preparations of lead, silver, and bismuth.

JACOBS' SIXTEEN-COLOUR CALICO PRINTING MACHINE.

(Illustrated by Plate 98.)

Calico printing ranks amongst the oldest industrial arts of the Indians and Egyptians. In the East it has been practised for "time out of mind," at Calicut—to which place we owe the name *calico*—and oriental labourers have also employed their time upon it in Asia Minor and the Levant for many centuries; but its practice here dates no farther back than 1696, when a Frenchman established a small "printfield" on the banks of the Thames, near Richmond. The second concern of the kind sprung up at Bromley Hall, in Essex—followed by numerous others in Surrey—called into existence by the demand for chintz, the importation of which, from India, had been prohibited by the government in 1700.

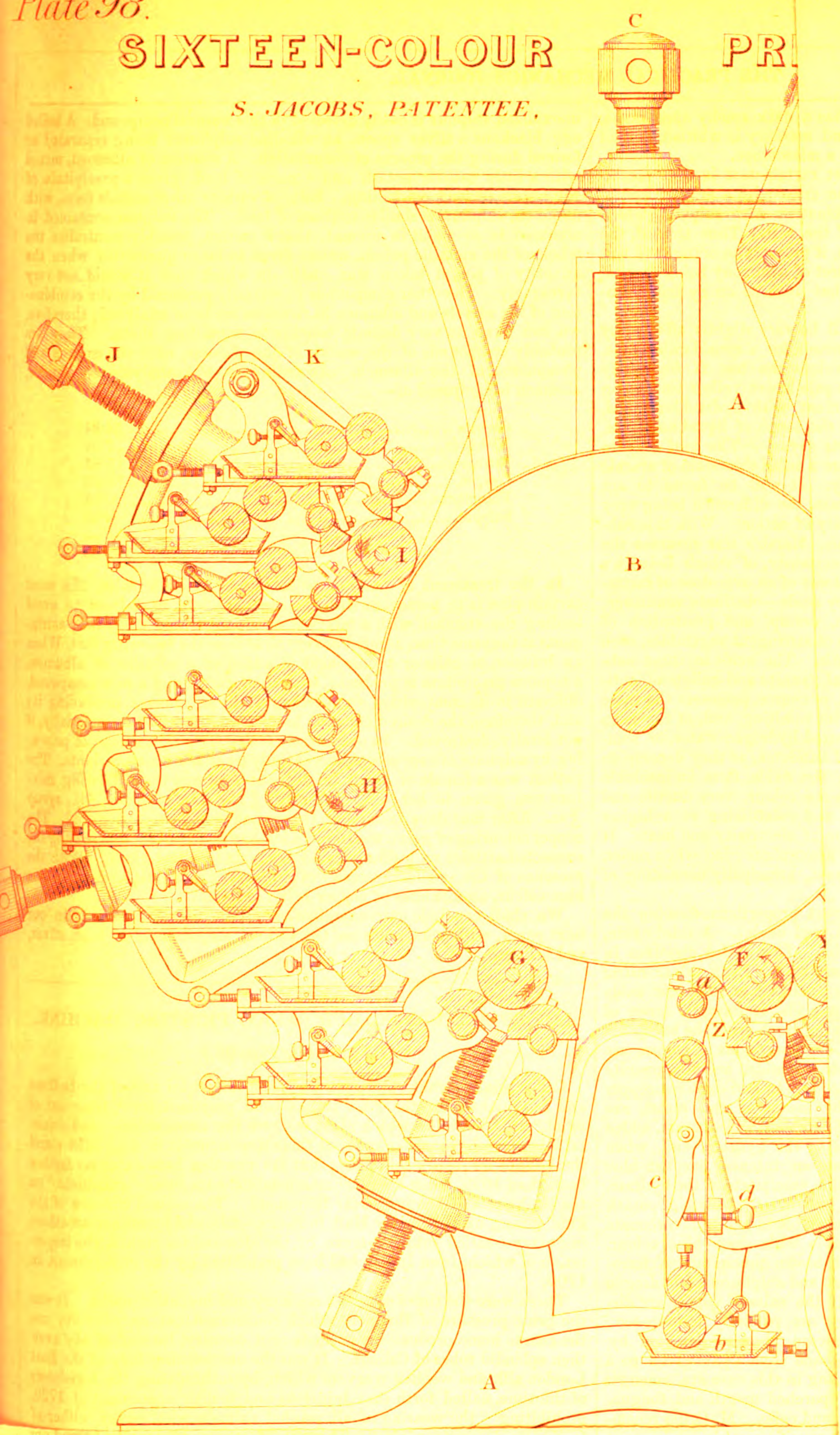
These were the times of anti-machinery and invention mobs. It was the brute pressure of the mobs which condemned our ancestors to use the coarse home productions of their own country, instead of the even then splendid robes of Calicut. It was the unreasoning fury of the East London silk and woollen weavers which, by intimidating the legislators of the time, called forth that injurious and foolish enactment of 1720, prohibiting "the wearing of all printed calicoes whatsoever, either of foreign or domestic origin." This act, of course, effectually barred our early progress in this department of industry; and it was only after a ten years' trial of its working that the partial enlightenment of those in authority permitted the printing and weaving of British calicoes, provided the warp was of linen, cotton only being used for the weft, under the astounding duty on the composite fabric of sixpence per square yard.

Our progress as printers was necessarily slow and laborious under such restrictions; and, so lately as 1750, not more than 50,000 pieces of these mixed fabrics were printed per annum. But sixteen years later the manufacture went into Lancashire, and here it soon showed signs of

Plate 98.

SIXTEEN-COLOUR PR

S. JACOBS, PATENTEE.



that wondrous extension which our days have seen so fully developed; and in 1774, when the compulsory use of the linen warp was done away with, the printer began to feel himself comparatively untrammelled, although still weighed down by a duty of 3d. per square yard, which was only finally removed in 1831.

In the times of which we have been writing, the printer's operations were confined to blockwork, cylinder-printing being a Scotch invention of very modern date. The invention, we say, is due to Scotland; but England has the credit of the greatest share in the practical working out of the details, the most prominent individual exertions being those of the Locketts of Manchester, aided by the American invention of Jacob Perkins, for "milling" the copper rollers.

Up to the present day, the greatest number of colours printed in one machine is eight—that is, eight printing cylinders only have so far been combined as to produce a printed design with eight distinct colours in it. It is, then, an important step which gives the power of printing sixteen colours, and that by a mere modification of the existing machines. Yet such a step has been achieved by Mr. S. Jacobs of Kendal, Westmorland, who, taking the ordinary six or eight colour machine, turns it into a sixteen or twenty-two colour one—that is to say, he is enabled, by his modification, to print sixteen or more colours in the length of the pattern. A machine on this principle is now working on the premises of Messrs. Hahnell & Ellis, at Manchester.

In our plate 98 is delineated a transverse vertical section of the machine. The main framing consists of two vertical end standards, A, of the usual kind, having central vertical slots in them for receiving the bearings of the main pressure cylinder, B, which are adjustable by the vertical screws, C. The six printing cylinders or rollers, D, E, F, G, H, and I, are set round the main cylinder in the usual way, each end having a radial adjusting screw, J, working through a nut in the cross-piece of the projecting cranked arm, K, the end of the screw being set to press upon the back of the roller-bearing, which is capable of sliding in a radial slot, for setting more or less hard up against the main cylinder. The first of these rollers has a single colour-box, L, and it consequently furnishes an impression in one colour only; but the remaining five, E, F, G, H, and I, have each three separate colour-boxes, printing as many distinct colours in the length of the passing fabric. The first printing action—that of the roller, D—is of course precisely similar in its arrangements to the ordinary mechanism of printing-machines. The colour-box, L, is carried upon a platform bolted to its corresponding frame-pieces, J, and is adjustable in position by small set-screws, M. The "doctor," or scraper, N, regulates the colour from the serving-roller, O, being capable of acting upon the cylinder with more or less pressure, just as the horizontal set-screw may be turned. The "server," O, dips into its colour, and, as it comes round, transfers its supply to the printing-roller, D, which finally delivers it, according to the pattern, to the fabric, Q, passing round the main cylinder. When an engraved cylinder is used, two doctors are attached thereto, one, N, to clear off the surplus colour, the other to clear away the lint and other impurities received from the fabric, as shown at P. After thus receiving a single colour impression, the fabric passes onwards beneath the second printing-roller, E, where it receives a further addition of three colours, derived from the three colour-boxes, R, S, T. These boxes are set on platforms, one above another, and carried by vertical end frame-pieces, screwed to the printing-roller framing, and carrying bearings for the several movements required in this differential colouring action. Each box, of course, has its serving-roller and doctor; but it is to the peculiar mode in which a single impression cylinder is made to deliver the three several supplies of colour, from these servers to the cloth, that we must now direct close attention. To effect this, each server, as it dips in the ordinary way into its colour, carries round the colour to a segmental roller, or what the inventor terms a "segment-furnisher"—a species of roller wherein the transverse section is only a portion of a cylinder. The segment-furnisher then conveys the colour so received, to the actual printing-roller, at such period of the revolution of the latter, and to such an extent, as the setting of the furnisher and its length of segmental colouring surface shall determine. Thus, in the simple arrangement of the second printing-roller, E, we have the server of the highest colour-box working in contact with, and so supplying colour to, the furnisher, V, which has 1-6th of its circumference cut away. It is thus capable of colouring 5-6ths of the surface of the printing-roller, E; and this amount is, consequently, printed on the fabric so as to keep register in the usual way with the impression derived from the leading roller, D. A third and fourth colour are then received from the two other segmental furnishers, W, which have surfaces of only 1-12th of their corresponding full circle. As these furnishers revolve, they come in contact, once in each turn, with their respective servers, X, and, on coming round, each segment "hits in" its colour upon the roller, E, at the particular time for which it is set, thus filling up the 1-6th of blank space left by the first furnisher, V. Our cloth has now received four impressions from the two rollers, D, E, and it passes to the third roller, F, to receive three more, supplied by the three furnishers, Y, Z, *a*, the first one having a surface of 2-3ds of the circle, and the other two 1-6th each. Here a difference occurs in the arrangement of the colour-boxes, the lowest one, *b*, of the series for the furnisher, *a*, being set low down, whilst the colour from the server is carried up by a constantly-traversing endless belt, *c*, and the furnisher itself is adjusted to the printing-roller surface by the set screw, *d*.

The rest of the printing actions are mere modified repetitions of what we have just explained. The fourth roller, G, has a furnisher one-half the circle, and two of 1-4th each. The fifth roller, H, has three furnishers of 1-3d the circle each, and the sixth, I, has three duplex ones, each with a combined area of 1-3d of the circle. The details beneath our main figure on the plate, represent, respectively, plain and differential furnishers, the upper one having a single segment, *l*, running from the end of the roller in a line with its axis, and is suitable for the common class of work. The corresponding roller beneath represents the segments stepped round a mandril and fastened by set screws, so as to be moveable to any portion of the circle for the delivery of the colour at any particular part of the pattern. These segments consist of a collar fitting the mandril, with angular flanges along the side, to secure the composition and covering of the segment, which form a soft elastic surface, becoming in operation so many rotatory "sieves" of different sizes. This arrangement displaces the sieve-cloth, which is an unnecessary and extravagant absorber of a large surface of colour for the supply of a comparatively small printing surface.

In tracing out the multiplied actions of this machine, we see that the first roller, D, which may be an engraved copper roller, prints the leading colour, or that which is continuous throughout the pattern. The second roller, E, which, like all the rest, is a "surface" roller, then comes in with its triple effect, putting in the shading or heightening of the first colour to the extent of 1-6th in one colour, and two other shades or tints at the top and bottom, in the middle, or in any other part where the design requires them. The third roller, F, then shades or tints 2-3ds of the pattern with one colour, and two parts, of 1-6th each, with two colours; and the three following rollers, G, H, I, in like manner, put in three different colours each, of varying lengths and breadths; thus completing an elaborate design with six printing cylinders, which, by the ordinary process, would require an immense machine of sixteen different printing rollers.

The facilities offered by this machine, in furtherance of artistic effect, may be rendered apparent by dissecting a variety of patterns of printed fabrics—cloth or paper-hangings. It will then be seen that the greater number of colours are "touches" in isolated parts, occupying only minute portions of the sketch; although examples are not uncommon where certain colours are spread over the pattern to "fill up," and often extended to a very faulty expanse, and in some cases made to occupy very unnatural positions, such as a pink patch on a green leaf, or other equally incongruous repetition of a colour, for lack of some other which the machine cannot put in, because it is limited to a certain number—three, four, or six, as the case may be. To this limiting character of the machinery may also be attributed the inefficiency, flatness, and want of finish in a multitude of patterns, many of which class readily enforce the conviction, that they might have been materially improved by a greater variety of tints and shades of the prevailing colours, and still further, by the removal of some portions of each colour, and the substitution of others—as, for instance, instead of a continuous repetition of red, pink, or lilac flowers throughout the piece.

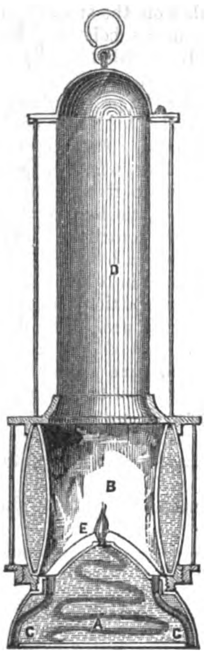
What we have explained, is only one of many modes of carrying out Mr. Jacobs' most ingenious invention.

ROSS AND HENDERSON'S MINER'S SAFETY-LAMP.

In presenting Messrs. Ross and Henderson's clever invention of the "plano-convex lamp-glass" last month, we gladly seized the opportunity of making "honourable mention" of the efforts of a working miner—Mr. Henderson, of Sunderland—for the improvement of the safety-lamp, and we now give an engraving of the lamp as improved in its other details by Mr. Ross, of the same place.

Our illustration represents the lamp in vertical section, by which it will be seen that it is essentially different from any other of the many existing modifications—in the important fact of its doing away entirely with the use of the wire-gauze, so long and so implicitly relied upon as the safety principle. The air necessary to support combustion is admitted through tubes inserted in the lamp for the purpose, the upper ends of these tubes being filled with small cylindrical wires, the minute

spaces or interstices so formed answering all the purposes of the wire-gauze, and at the same time presenting a form much less favourable to the transmission of flame to the exterior of the lamp. Then, as it receives its air from beneath the flame, and is constructed on the solar principle, with a deflector placed so as to cause the consumption of the smoke as quickly as it is generated, it is unnecessary that the upper cylinder should be perforated to any greater extent than is absolutely requisite for the egress of the heated air. Mr. Ross, therefore, makes the upper cylinder of mica or talc, with a perforated copper top; but as an abundant supply of light will be afforded by the lower convex cylinder which surrounds the flame, the upper one *may* be made entirely of copper. The lamp itself containing the oil and cotton wick is placed at A, in the base, and over this is a double convex glass, B. This glass is similar to that described at page 10 of our last number, with the exception of both the inner and outer surfaces being convex, the enclosed space between the two cylinders being filled with water. The light of this lamp is equal to that derived from eight or ten Davy lamps, and is, consequently, much superior to that of the Clanny. In point of safety, it is better contrived than any other plan wherein glass is a component part, as, although the outer division of the glass, B, may be broken, so as to let the enclosed water escape, the lamp still remains as a perfect Clanny, with the single inside glass; and it is pretty certain that such a blow as would fracture both glasses, would inflict such injury upon one made entirely of gauze, as to render it equally useless or dangerous.



1-4th.

The tubes for the conveyance of the external air to the flame for combustion are at C, the upper ends alone above the bends being filled with the subdividing wires, for the obtainment of the minute air spaces. D is the mica cylinder, with its top of perforated copper, or, where light is not the primary object sought, of copper altogether. The deflecting smoke consumer is at E, surrounding the flame.

We hope soon to see this lamp very extensively adopted; for, being partly the invention of a practical miner, it embodies many points of excellence only to be arrived at by long experience in the actual working of the ordinary lamp, and a keen perception of the difficulties to be surmounted.

THOMSON'S SLUSH LAMP FOR NIGHT SIGNALS AND THE DECKS AND MESSES OF SHIPS.

Whilst science has latterly done much for the improvement of lighthouse illumination, in all quarters of the maritime world, it has almost wholly neglected the many other most important applications of light for telegraphic purposes—the detection of shipping at sea, or the internal economy of our mercantile marine and vessels of war. This is a matter for painful surprise, when we remember that the collisions of British ships alone, during the last five years, amount to more than two thousand.

After sunset, no vessel can hold satisfactory intercourse with another, or with the shore. In the British navy, the signals are excessively limited; they do not extend beyond twenty numbers without rockets or guns, which it is not desirable to use in the presence of an enemy. Hence the imperative necessity for a more extended intercourse and immediate communication (especially since the introduction of steam) has become most apparent to every officer of intelligence. Besides, the internal comfort, increase of discipline, and morality, of our sailors in their messes in the 'tween-decks, are greatly dependent on a proper system of lighting. The decks have hitherto been most inefficiently lighted, and yet the expense of that inferior light reaches from 15s. to 20s. or more per night for every line-of-battle ship.

It is, however, gratifying to know that this evil may be remedied by means within the power of every commanding officer, when the ship's crew are on salt provisions, by the application of Mr. Thomson's "slush lamp," and the consumption of fat from the meat, cleansed from all saline particles and impurities. The cleansing of the fats (which, until now, have been mostly considered the perquisite of the ship's cook, and wholly unavailing, in this point of view, for the naval service) is effected by reboiling in fresh water in the ship's coppers. When beef fat is to undergo the process, before being reboiled in the water, its impurities must be shaved off the hardened cake resting on its bottom, consequent on the first cooling. After the fat has been placed in, and has continued boiling in the fresh water for half an hour, it is to be skimmed off and placed in a tin pail, containing some fresh water kept at the boiling point, by being permitted to stand for a few seconds in the boiling water of the coppers. It is then to be permitted to cool slowly; and should there be any impurities remaining, they will appear at the top and bottom, the remainder being fit for combustion. Pork slush requires the same process for cleansing, with the exception of the first cooling to a cake.

Our illustrations represent full details of Mr. Thomson's contrivance, as used for consuming the waste fat on board H.M.S. *Impregnable*, the flag-ship at Devonport:—

Fig. 1 is an elevation of the lamp, with its smoke-shield and parabolic reflector. Fig. 2 is a corresponding side-view of the lamp. A, is the reflector; B, the smoke-shield; C, the stand; and D, a pair of button-

Fig 1.

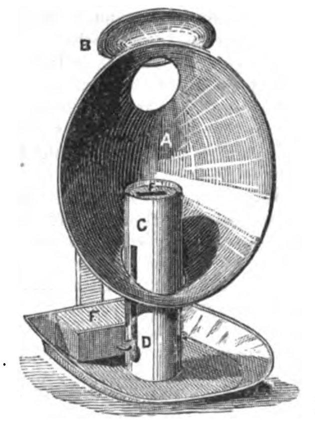
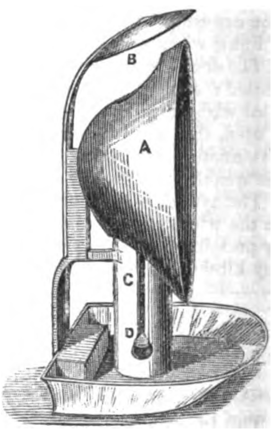


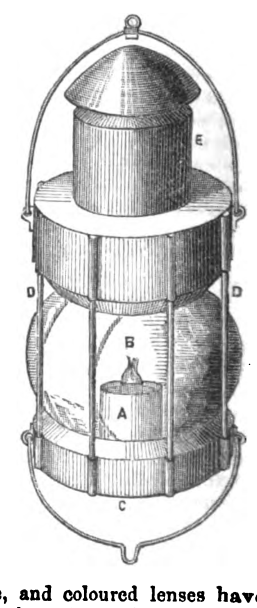
Fig. 2.



handles for propelling the grease towards the flame. The wick tube is at E; and the wick and probe-box, F, lies on the lamp base. The wick is an oiled one of several strands, and of several twisted threads to each strand.

Fig. 3 is a view of Mr. Thomson's "Telegraphic Lamp with coloured lenses, lighted by the Slush Lamp." With respect to the use of coloured lights in all states of the weather, we everywhere meet with different opinions; and it is notorious that, so far, no leading principle has yet been introduced for the guidance of the seaman. It has been generally thought that, in certain states of the atmosphere, red and white would be mistaken for each other; but now, after eighteen months' constant and severe test, this has proved to be erroneous,—for, under such circumstances, the red and white have been clearly distinguishable at three-and-a-half miles' distance. This has been set at rest by a committee of intelligent scientific naval officers, appointed by the Lords of the Admiralty. Such lights are best seen by a day telescope, or a day and night, but not a night glass entirely.

Fig. 3.



In our illustration, A is the tallow-holder, set so as to be focal to the surrounding lenses; B, the circular lenses, white, red, or green, $1\frac{1}{2}$ inch thick; C is the bottom, with a flap for the introduction of the tallow-holders; and D are brass supports, for binding together the upper and lower portions of the lamp. Into the top, E, of the lamp may be introduced one red and green cylinder, either of which may be let down at pleasure between the lens (if the latter is white) and the light. These coloured cylinders have been removed from the lamp by order of the Admiralty, at the suggestion of the committee on night signals, owing to their liability to fracture, and coloured lenses have been substituted. Thus arranged, the number of signals is reduced, leaving, however, sufficient variations for all practical purposes.

A detective light for Channel purposes may readily be obtained by the use of the Telegraphic Light, which, with the forementioned cylinders or coloured plates of glass, will give the distinctive colours at three-and-a-half miles' distance, in all states of the weather.

By such a measure, Mr. Thomson shows that all the means are readily to be obtained and easy to be applied, so as effectually to ameliorate the condition of seamen, and reduce, if not entirely prevent, collisions at night.

Every vessel, the moment she leaves harbour, or approaches the chops of the Channel, to show on what tack she lay, would hoist a red or a green light at the fore truck; and if before the wind, or at anchor, a white light. And as a circular parabolic tin lamp might be substituted for the lenses, no ships, boat, ketch, or hoy, ought to leave port, or be under sail, without some such detection.

This candle-lamp requires no snuffing; it is cheaper, cleaner, safer, and more easily managed than any other, and is suited for seamen, and for whom it was solely invented. The wick of an inch long burns a week; and the grease is so locked up that it cannot well escape. There is no waste; every particle of grease must be consumed; it is portable, and is suited to bed-rooms, drawing-rooms, kitchens, or board-ship. The consumption of tallow, expense, diameter of cylinders, and amount of light, will always bear a relative proportion to each other.

The double tubes give this lamp an advantage over any lamp yet invented; a capillary power is imparted, by which the wick is really supplied with grease when out of the fat; and, if an extra-surrounding wick is used, this capillary power is greatly increased. These double tubes give another advantage to the lamp, which renders it unnecessary to use washing and cleansing.

The cylinder can be filled in an instant, by simply placing the finger on the wick, and pressing the mouth down into the fat, and, when full, by pressing the two cylinders together again. It burns the refuse of any kitchen with great ease.

RECENT PATENTS.

COTTON MACHINERY AND FANS.

John Platt *and* Christian Schiele, *Oldham.—Enrolled April* 22, 1852.

This important invention relates, in the first place, to a peculiar arrangement of exhausting fans for scutching or preparing machines. The shape of the revolving fan-discs is that of a species of conoidal saucer, carrying upon the air-receiving side a set of differentially curved vanes or wings, which take in the air at the centre of the outer case, and discharge it over the disc's periphery, against the rounded internal surface of the fixed outer case. This outer case is in two halves, bolted together by circumferential flanges; and as the air passes over the periphery of the fan-disc, it is received by the second half of the case, which is also conoidal like the first, and has within it a series of fixed wings, which gradually retard the current, and finally guide it to the centre of the case. Here it emerges into a suitable duct in the axial line of the fan-shaft. The revolving vanes are so curved towards their outer ends in the opposite direction to that of revolution, that the rapid succession of each curved piece, forms, as it were, a cylindrical case, to prevent the return of the air when once expelled from the disc. As adapted for scutching machines, two fans are worked together on the same shaft, being made to face each other, and deliver their currents in opposite directions into an intermediate pipe. The fans are, of course, applicable for all the uses of the ordinary fans, and they may be used singly, but always taking in and expelling the air in the direction of their axial line. The peculiar form of cone for the disc and outer case, is chosen for the purpose of providing a uniform space for the passage of the current at all diameters. When two fans are worked together, the lateral pressures of the discharging currents balance each other; but, when worked singly, this pressure is received on an end-bearing, constructed on Mr. Schiele's well-known "antifriction curve" principle. The tendency of fans of this kind is to discharge the air only on the outer side, at right angles to the line of revolution, without the assistance of an outer case.

Another branch refers to a system of lubricating spindles and other revolving portions of machinery. For instance, in the example of a "throstle" spindle, the base of the step, which is of the antifriction kind, has formed within it a small oil reservoir, directly beneath the axial line of the spindle. This reservoir opens through the bottom of the rail, where it is plugged up, so that the interior may be examined from time to time; and its upper end is conical, and communicates by a small aperture with the lower conical end of the step. As the oil works through from above, it escapes into the reservoir beneath; and any impurities are also easily cleared off the rubbing surfaces, by pushing them down through the small communicating hole. Whatever oil is not actually in use, is thus kept free from the action of the atmosphere; and as the impurities collect in the reservoir, they are easily removeable by the plug beneath. The same principle is also adapted, under slight modifications, to horizontal bearings.

The patentees also propose to fit cast-iron bushes on the spindles of spinning machinery, at the part where they work in the bolster of the spindle-rail, as well as to form the spindles themselves, either wholly or in part, of cast-iron, and particularly to give them a cast-iron foot.

As an improvement on the "beater," or opener, for the preparation of cotton, the patentees also propose to fix on the cylinder long wire cards or teeth, in strips, alternating with the beater knives. The result of this arrangement is, that as the beater-cylinder revolves, whatever portions of the treated fibrous materials are left by the disintegrating knives of the beaters in advance of the cards, are combed out by the long teeth of the latter, and the dirt so drawn out is thrown off by the centrifugal force.

The last head of improvement is upon the shaper-rail of the self-acting mule. In this arrangement, a joint is introduced into the shaper-rail, the centre of this joint being made to rest upon an additional shaper-plate introduced between the two shapers, as already in use. The first plate of the series is of such a contour, that, with the aid of the joint in the shaper-rail, the two ends of the rail may be in the same plane at the beginning and end of the "winding on," at every stretch of the carriage. During the going down of the faller, as the carriage is being run in to the roller beam, this action causes more crossings, and, consequently, a firmer and more compact cop than can be obtained by mules of the existing kinds.

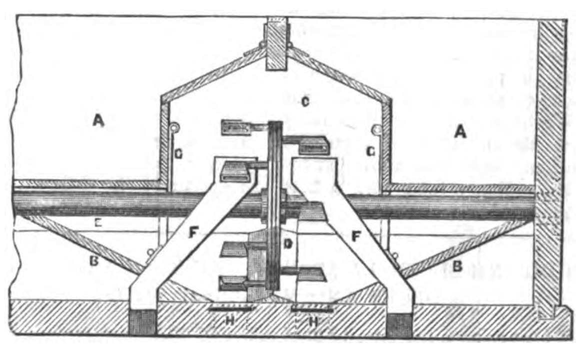
We shall probably be enabled, on a future occasion, to illustrate the entire details of this invention.

SOWING MACHINE.

Ernst Kaemmerer, *Ironfounder, Bromberg, Prussia. Enrolled March* 25, 1852.

What has hitherto been one of the most tedious of agricultural operations, namely, that of sowing by broadcast, dibbling, or drilling, is accomplished by this machine in an efficient and expeditious manner.

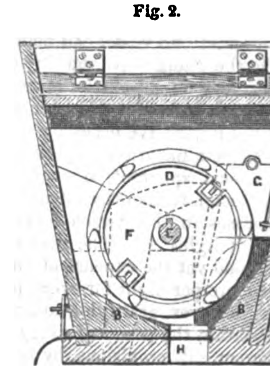
Fig. 1.



1-8th.

Fig. 1 of our engravings represents a longitudinal section of one of the compartments of the machine, and fig. 2 is a corresponding transverse section at right angles to fig. 1. The seeds are put into the receptacle, A, and slide down the inclined bottom, B, into the seed-distributing chamber, C. This chamber contains a small bucket-wheel, D, keyed on to the shaft, E, and two seed ducts, F, F. There is a sliding door, G, G, on each side of the chamber, C, for the purpose of regulating or stopping the admission of the seeds from the receptacle, A; H, H, are sliding doors in the bottom of the seed-distributing chamber, for the purpose of emptying it when required. The buckets are so made, that, when one has just emptied itself into the seed duct, the following one commences to discharge, thereby keeping up a constant and regular supply. But when the seed is required to be sown at intervals, or dibbled, then a set of

Fig. 2.



1-8th.

buckets are used which discharge their contents at once, each being emptied before the next begins to discharge. In dibbling, six buckets are used to each wheel, so that three only discharge into each seed duct; but in sowing broadcast, or drilling, a wheel with twelve buckets is employed, as shown in the drawing—six discharging into each duct. The buckets are attached to a ring which is fitted on to the wheel, thus affording great facility in changing them. The patentee prefers casting them in brass, in one piece. The mode of attaching the rings is shown in fig. 2. The requisite motion is given to the shaft, E, by a pinion keyed, or otherwise screwed, to the inside of the boss of the ordinary moving wheels, this pinion gearing into a toothed wheel on the end of the shaft, E.

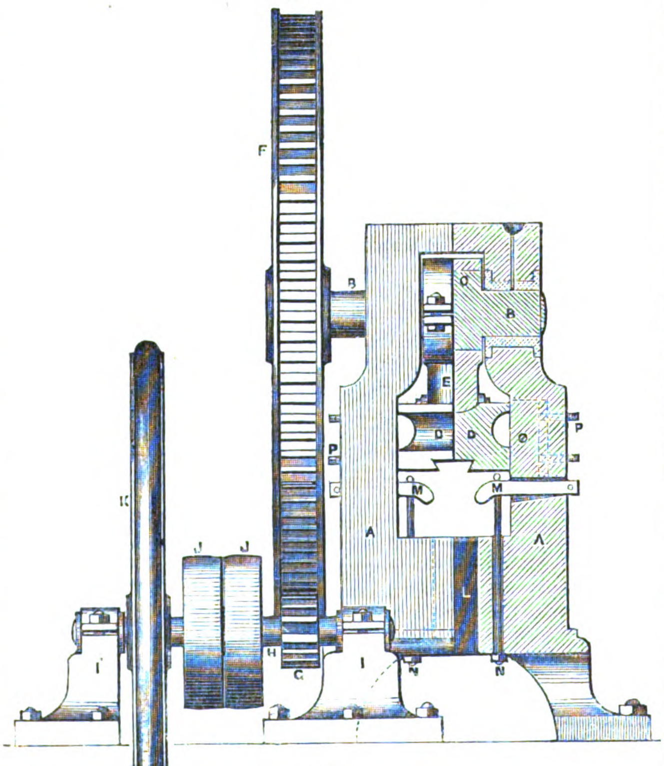
When sowing broadcast, an inclined board is suspended under the mouths of the seed ducts, and this board is fitted with two or three ranges of short pegs, set at various distances, in order that the seeds may be more effectually and evenly distributed over the land. In drilling or sowing in parallel lines, the mouths of the seed ducts have branch tubes fitted to them, thereby conveying the seed by three or more different channels from each of the seed ducts in the machine. Of course, the branches are regulated according to the width of drill required.

MANUFACTURE OF SCISSORS.

Hubert Sommelet, *Manufacturer, Paris, France.—Enrolled April* 10, 1852.

According to this invention, scissors are manufactured by being first punched out of a sheet of steel, then slightly forged, and afterwards stamped or pressed into shape. The after processes of polishing and finishing are effected by suitable grooved rollers of steel, whose surfaces are roughened like a file, some of the grooves being finely cut, for the

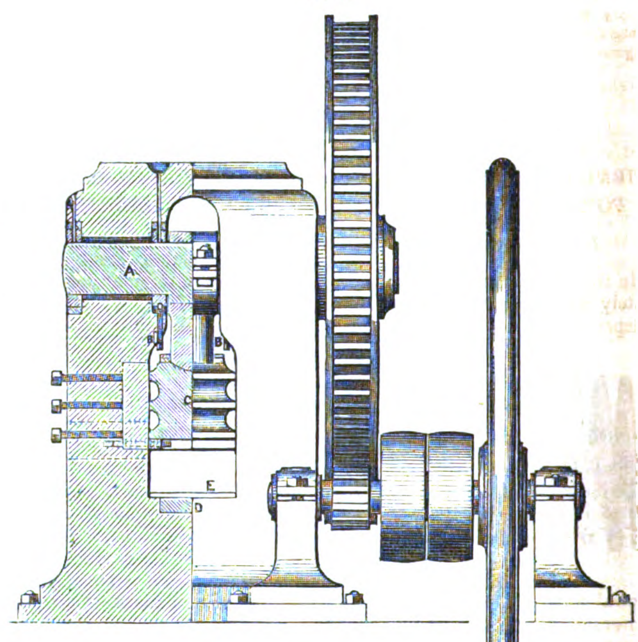
Fig. 1.



1-16th.

purpose of finishing, and others formed with large rough teeth, for effecting the cutting away of the metal when it is required. Wooden rollers of a similar construction are employed for polishing, after the scissors have been filed as already described. Fig. 1 of our engravings represents a side elevation, partly in section, of the machine for cutting out the blades of scissors from one sheet of steel. A, is the cast-iron standard of the machine, having, at its upper end, the shaft, B, which has an eccentric, C, forged upon it for actuating the vertical slide, D, through the short rod, E—this rod being connected to the eccentric by a ring, in the ordinary manner. A large spur-wheel, F, is keyed on to the extremity of the shaft, B, and gears with the small pinion, G, on the driving shaft, H. This shaft works in the bearings, I and I′, the bearing, I, being cast in one piece with the standards of the machine. J, J, are fast-and-loose driving pulleys, and K is the fly-wheel. The under side of the slide, D, is formed with a dovetailed groove to receive the requisite cutting die in relief, whilst the lower one, which consists merely of an aperture, corresponding in shape to the relief of the upper die, is retained in its place over the opening, L, by the two clamps, M, and screw-bolts, N. The slide, D, may be tightened by the side-piece, O, and adjusting screws, P. As the blades of the scissors are cut out by the descent of the upper die on to a sheet of steel, they drop through the opening, L, into the space beneath the machine. They are then forged, and taken to the stamping or moulding machine, fig. 2. This machine is much larger and stronger than the cutter,

Fig. 2.



1-24th.

though somewhat similar to it in general outline. The eccentric shaft, A, of this machine works in four sets of brasses, the lower inside ones being adjusted by the screws, B. The slide, C, which carries one of the moulding dies, is tightened as already described in reference to the cutting-machine. In place of the opening, L, in that machine, a block of steel, D, is inserted into the bed, thus giving a firm support to the lower die or mould. The position of this die is regulated by the guide or stop, E, which allows it to come immediately beneath the upper die. These dies are two intaglios, corresponding, when together, to the blade of a pair of scissors, so that when the piece, previously cut out by the cutter, is placed exactly over the matrix of the lower die, the descent of the upper one produces the required shape. After each stroke of this machine, the lower die is traversed outwards, and allows the stamped blade to be removed, whilst a fresh piece of metal is inserted for the succeeding stroke. The blades so formed are now ready for dressing and polishing, which operations are effected in the manner before described. The dies or matrices of the stamping machine, are formed by a highly tempered steel punch of the shape of the required matrix; and this punch is driven into the moulds, which are of very soft steel, and thus two perfect counterparts are produced. The matrices are then highly tempered, and are fit for use. None of the dies are represented in the drawings, as they do not differ in outward appearance from the usual cutting and stamping dies.

MECHANIC'S LIBRARY.

Architecture, Short Hints to Students in, 12mo, 2s. 6d. cloth. Roberts.
Arithmetic, "Weale's Series," 12mo, 1s. 6d. sewed. J. R. Young.

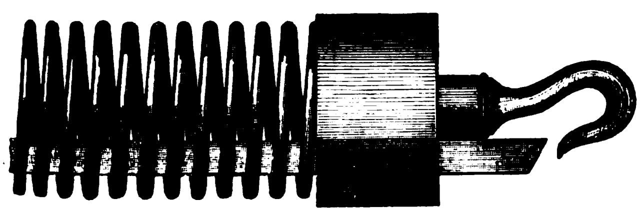
Assay of Gold and Silver Wares, post 8vo, 6s cloth. Ryland.
Bridges, Dempsey's Work on, 3d and 4th series, 31s. 6d. each.
Crystal Palace and its Contents, 4to. 5s. cloth.
Draining, Tables for, 24mo, 2s. cloth. J. B. Denton.
Euclid, The Elements of, fcp. 8vo, 9d. cloth. J. Lowress.
Figure Drawing, Art of, 12mo, 1s. sewed. C. H. Weigall.
Geology, Recreations in, 3d ed., 12mo, 4s. 6d. cloth. R. M. Zornlin.
Geometrical Construction of a Conic Section, 8vo, 3s. T. Gaskin.
Land Drainage, new edition, 12mo, 1s. sewed. J. Donald.
Land Surveyor's Ready-Reckoner, new edition, 2s. boards. S. Thurlow.
Mathematics, Elementary Course of, vol. 2, royal 8vo, 18s. cloth.
Millwright and Engineer's Companion, 9th ed., 5s. Templeton.
Miners, Tables for the Use of, sq. 6s. cloth. W. Whitburn.
Naval Architecture, post 8vo., 6s. cloth. Lord R. Montagu.
Navigation and Nautical Astronomy, Practice of, 4th ed., 16s. cloth. Raper.
Negative Sign, Theory of the, 8vo, 3s. 6d. sewed. H. B. Browning.
Organic Chemistry, Hand-Book of, third edition, 9s. 6d. Dr. Gregory.
Physical Astronomy, History of, 8vo, 16s. cloth. R. Grant.
Practical Mathematics, System of, 5th ed., 10s. 6d. J. Davidson.
Printer's, Grainer's, and Writer's Assistant, 12mo, 2s. E. Barber
Science, Magazine of, vol. 14, 1851, 8vo, 12s. cloth.
Tables for Calculating Cuttings, 8vo, 2s. cloth. J. Henderson.
Trigonometry, Plane and Spherical, parts 1 and 2, 4s. each. H. W. Jeans.

REGISTERED DESIGNS.

SPIRAL EXPANDING AND CONTRACTING WRAITH OR COMB FOR SIZEING, WARPING, AND BEAMING MACHINES.

Registered for MESSRS. KENWORTHY & JAMIESON, *Blackburn.*

In the two elegant little contrivances embodied in this and the immediately succeeding design, we have an example of two different and independent modes of simultaneously working out the same idea. The



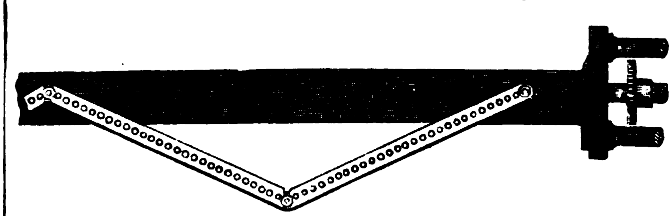
"spiral wraith" is the invention of Mr. Kenworthy of Blackburn, whose numerous and valuable improvements have so largely contributed to the prosperity of our textile manufactures. The convenience of an expanding and contracting power has long been understood by every practical manufacturer, but Messrs. Kenworthy & Jamieson have been the first to carry the idea into practical workshop use. Mr. Kenworthy's plan of the spiral comb, of which we present a view in the annexed engraving, is more particularly suited for the *beam warping machine*, where varying numbers of ends are required to come into the same or different widths of flanging on dressers' and sizers' beams. It is nothing more than a wire helix, long enough to take in the greatest width of warp, and having a hook attached at each end for the purpose of enabling the attendant to stretch the helix at pleasure. As each coil expands the same throughout the whole length, this simple plan affords the readiest possible means of accurately guiding the threads to any width for which it may be set. A lath or rail passed through the coil from end to end, forms the stay or horizontal bearing surface for the warp in passing through.

Whilst the inventor's attention was engaged with this plan, it turned out that Mr. Jamieson, of Ashton-under-Lyne, had been seeking a similar result, and this led to the amalgamation of the two names in connection with their respective contrivances.

(ZIG-ZAG) EXPANDING AND CONTRACTING WRAITH.

Registered for MESSRS. JAMIESON & KENWORTHY, *Ashton-under-Lyne.*

Mr. Jamieson's "zig-zag" comb, a portion of which is delineated in plan, in our accompanying figure, is better suited for "winding on" or "beaming" warps for weaving, as well as for Messrs. Hornby & Kenworthy's patent sizeing machine, where it is frequently desirable to accommodate the same wraith to different sorts, and to different widths of flanging beams. The teeth of the comb are carried on four short lengths of frame-pieces, jointed together, a fixed centre joint being provided in the middle of the comb's length, whilst each end of the chain is jointed to the traversing nut of an adjusting screw. By this means, the jointed pieces may either be drawn out quite straight, to give the full pitch of comb, or they may be contracted to any extent, in the



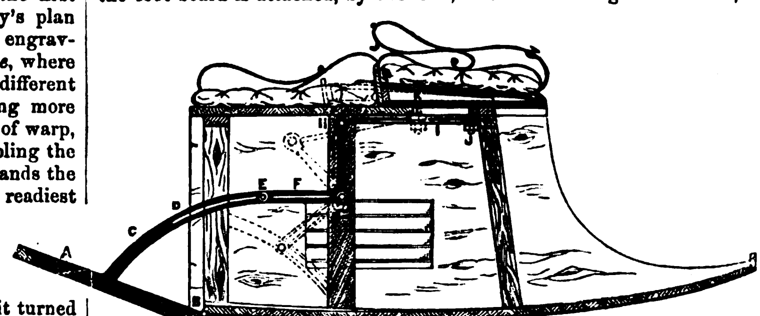
zig-zag form, as shown in the figure, the angle of each length, in relation to the right line of the warp passing through, having the effect of reducing the pitch in accordance with the extent of such angle. Both the comb and wraith are of important use in dispensing with large heavy flanges, still preserving the diameters of the full beams respectively. This is accomplished by allowing the wraith or comb to contract—by a screw or worm motion—after the flanges are full, whereby the ends of the full beam are made uniformly taper or "cop" shaped, so that the size of the full beams may be carried to any desirable extent. Both plans are as effective as they are simple.

SELF-ACTING BALANCE SEAT FOR CARRIAGES.

Registered for MR. G. MACINTOSH, *Carriage Builder, Canning Street, Glasgow.*

The object of Mr. Macintosh's clever and simple contrivance is, "the obtainment of an automatic action for carriage seats, so that the vehicles may be kept in perfect equilibrium, whether passengers are or are not carried on both sides of the axle, without the necessity of periodical manual adjustment." In all ordinarily constructed vehicles of the "dog-cart" class, the equilibrium can, of course, only be preserved under the varying circumstances to which we have alluded, by setting the seat back or forward by hand, accordingly as one or both seats are used; or the improvement on this plan, wherein the back foot-board shifts the entire body as it opens or closes. But Mr. Macintosh's arrangement—the "self-acting balance"—is obtained by merely moving the front seat in connection with the foot-board.

Our illustration represents a vertical longitudinal section of the body of a dog-cart, to which the design is fitted. The requisite movement is effected by the opening and closing of the foot-board, A, of the hind seat, which is hinged in the usual way, at B, to the body. On each side of the foot-board is attached, by one end, a curved or segmental lever, C



1-19th.

arranged so as to work into and out of the interior of the carriage-body, just within each side. The projecting end of each of these levers is slotted through as at D, to receive a double-headed stud-bolt or pin, E, which is also passed through a similar slot in the horizontal arm, F, of a bell-crank lever, working on a fixed centre at G, in the interior of the body. The vertical arm of this lever is connected by an eye at H, with a short link-piece, I, the opposite end of which has a wide eye passed upon the end of the short vertical stud-bolt, J. This bolt is attached to the under side of the front adjustable seat, K, of the carriage, and projects through a short, narrow slot in the top of the body. The mechanism is precisely the same on each side. Our figure represents the dog-cart as adapted for conveying a passenger on both seats, the foot-board, A, being opened, having in the opening action pushed forward the front

seat to the requisite distance in front of the axle, so that the leverage of the front weight is so much increased as to balance the weight of the passenger on the hind seat. When the foot-board is closed, by being turned up on its hinges, the front seat is again drawn back to bring the weight upon it nearer to the axle, and preserve the equilibrium on the absence of the passenger behind. The dotted lines represent the position taken up by the mechanism when the foot-board is closed, the inward traverse of the levers, C, bringing down the arms, F, of the bell-cranks, and thus drawing back the front seat. The stud-bolt, E, is fitted loosely into the two slots in the levers, so that it may traverse freely during the movement. In this arrangement, the curved levers, C, answer for the support of the foot-board when open, thus dispensing with straps or other supports.

An important point in this contrivance is, that the mechanical action is entirely concealed in the body of the carriage, there being nothing whatever to project outwards but the segmental levers, C, which carry the foot-board, and are scarcely distinguishable from the ordinary straps used for this purpose. The improvement promises to be of peculiar importance to all conveyances of the two-wheeled, double-seated kind.

RING MILL-STONE.

Registered for MR. G. MULLIN, *Flour Miller, Glen House, Gilford, Ireland*

The contemplated advantages of Mr. Mullin's design are fourfold—economy in manufacture, simplicity and effective ventilation, increased production of meal, and a saving of labour in repairs. Fig. 1 is a vertical section of the stone, and fig. 2 is a corresponding plan. The "eye," A, is made excessively large in proportion to the stone's diameter, exceeding indeed half the latter dimension. This increased area admits a greater volume of air than is usual, and this air, coming in contact with the more rapidly revolving portion of the stone, is passed between the working surfaces by the action of the centrifugal force. Besides, the increased circumferential length of the eye admits of the formation of three or four times the ordinary number of leading furrows, for the distribution of the air over the grinding surfaces, and thus more grain is ground, without any risk of overheating by friction. Finally, by getting rid of the great area of superabundant stone at the centre, the operation of dressing is obviously simplified very considerably.

Fig. 1.

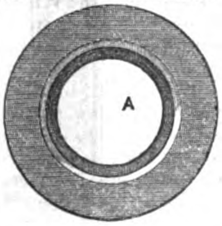
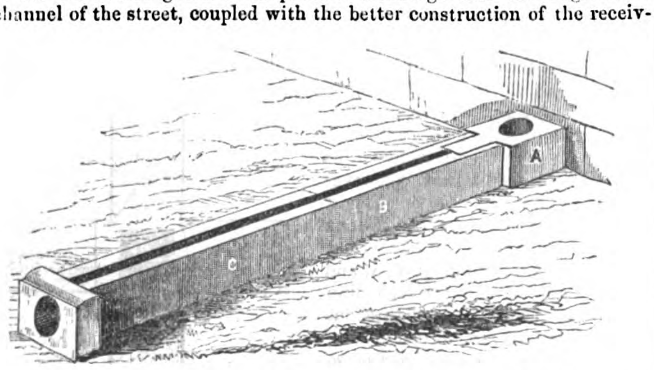


Fig. 2.

STREET GUTTER, OR WATER CHANNEL.

Registered for MR. H. SWIFT, *Statuary, Ipswich.*

The object of Mr. Swift's design is the more substantial termination of the transverse gutter at its point of discharge into the longitudinal channel of the street, coupled with the better construction of the receiv-



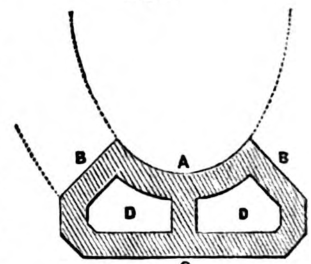
ing-head at the delivery-spout of the house. The sketch exhibits the gutter in perspective; A being the receiving-head, formed in one piece by itself, and jointed to the intermediate length, B, which again joins up to the third piece, C. By being made in three lengths, accidental fracture is easily and cheaply remedied. The sketch itself explains the points of advantage in the new shape of the two parts to which we have referred.

INVERT BLOCK FOR THE BOTTOM OF SEWERS.

Registered for MESSRS. H. DOULTON & CO., *Lambeth Pottery.*

This "Invert Block" is intended to form a uniform and permanent surface for the bottoms of sewers and culverts, in addition to making a better foundation for the structure. The sectional elevation, fig. 1, represents the position of the block in the sewer, a portion of the outline of which is delineated in dotted lines. Fig. 2 is a plan of the blocks in line. The concavity, A, coincides with the "egg" curvature of the sewer, whilst the sides, B, are inclined at the proper angle for receiving and supporting the superstructure. The base, C, is level to afford a good bearing surface, the hollow, D, being simply to lighten the block. The plan shows how a line of the blocks is bound or interlaced together by the convexity and concavity of the opposite parallel sides or edges. The block is made of the ordinary stoneware used for the drain pipes, in which manufacture Messrs. Doulton have become so eminent.

Fig. 1.



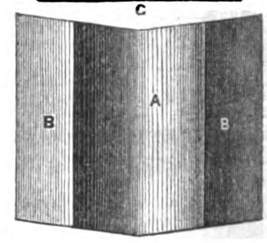
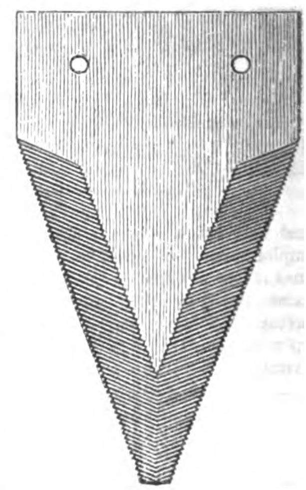


Fig. 2.

REAPING MACHINE KNIFE.

Registered for MESSRS. C. GRAY & SONS, *St. Philip's Works, Sheffield.*

The cutting action of the three leading reaping machines—the "M'Cormick," "Hussey," and "Tollemache," as the attentive visitor to the Exhibition and the recent Agricultural Shows is aware, is effected by the reciprocating movement of a horizontal bar, armed with a bristling row of projecting knives of various configurations. It is on this class of cutter that Messrs. Gray, the extensive Sheffield edge-tool makers, have worked out their present improvement. Our engraving represents the serrated face of their knife, which is cleverly contrived to keep up a keen cutting edge, whilst it prevents the slipping away of the straw from the cut. One side is a plain swage or bevel, whilst the opposite one is cut or indented with fine angular grooves. The superiority of the cutter is to be found in the teeth, or cutting on the indented side. It must be obvious to the practical user of cutting tools, that, in addition to the points of advantage already mentioned, this arrangement is much easier sharpened, from the fact of there being only one levelled side—the indented side being set downwards in the machine.



CORN ROUGHING AND DRESSING MACHINE.

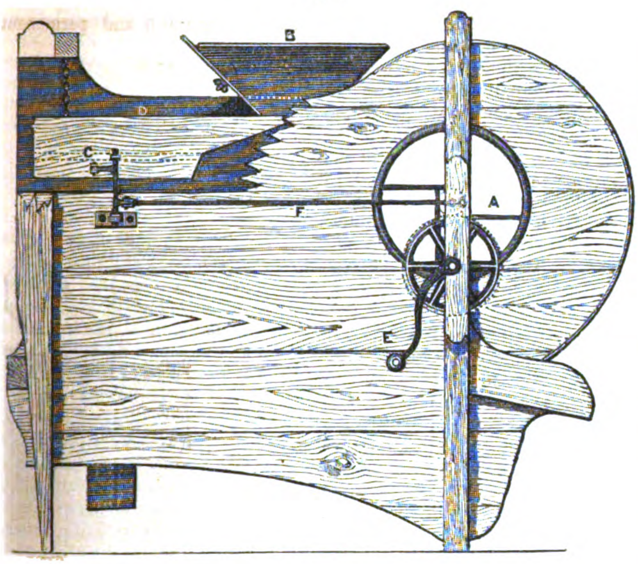
Registered for MR. W. WALKER, *East Bridgeford.*

The powerful blast of this machine peculiarly fits it for dressing corn when in a very rough state, as well as for the separation of the inferior grain from the best quality. It is fitted with a forked shaker, capable of being put in or out of gear as required, and acting in a direction opposite to the riddles. The machine may also be used as a blower, for cleansing the corn from small seeds in readiness for the market.

Fig. 1 is an elevation, and fig. 2 a plan of the machine.

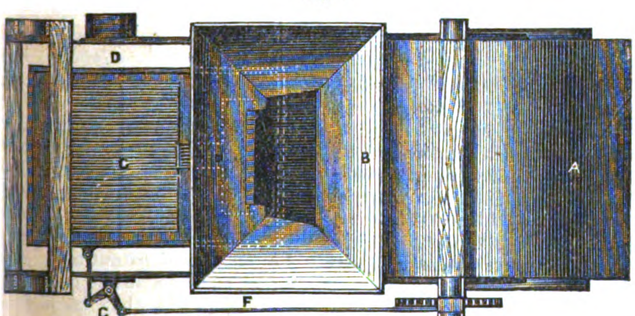
The blowing action is obtained from the fan, A, the grain being fed by

Fig. 1.



the hopper, B. A grating, or comb, C, is fitted within the sieve, D, to which motion is given by the fan-winch, E, by the connecting-rod, F,

Fig. 2.



and belt-crank, G. It is a very complete and satisfactory implement. Its performances may be measured by the fact, that it has roughed twenty-seven quarters of wheat, as it came from the thrashing-machine, in four hours. In another instance, when tried upon wheat so rough as to be made up with a fork, it got through twenty-eight quarters in six and-a-half hours.

SCREW KEY.

Registered for MR. E. EVANS, *Brixton Road, London.*

This key, which the inventor terms a "screw, gas tongs, or wrench," is one of the numerous modern modifications of the old "monkey" class of implements. In the form which our engraving exhibits, it is intended for holding pipes and couplings, to assist the gas engineer in forming connections. The fixed jaw, A, is in one piece with the intermediate screw, B, and handle, C. The moveable jaw, or "tongue," D, is hinged by one end to a collar-piece, E, which is fitted to slide loosely over the screw, but incapable of turning round upon it, owing to the screw being formed with two opposite flat sides; and a small blade spring, F, keeps the tongue constantly pressed towards the lever arm or stem of the fixed jaw. One side of the collar, E, fits loosely into a groove in the front end of a nut, G, which works upon the screw. By turning this nut, the moveable jaw is shifted nearer to, or further from, the terminal fixed jaw, and the peculiar formation of the jaw portions affords the means both of a convenient adjustment and a secure hold.

BEDSTEAD LATH.

Registered for MESSRS. GEO. FLETCHER & CO., *Wolverhampton.*

Fig. 1 of our engraving is a plan of a portion of an iron bed frame, with the end of a lath, as broken away from the main piece attached thereto. Fig. 2 is a corresponding edge view. The lath is ingeniously fitted to the frame, by bending each end for some five or six inches, at a right angle, the bent portion or angular piece being afterwards rebent outwards, near the middle of its length, to an acute angle, so as to bring it to the form represented at A. Then the horizontal flange of the angle iron of the frame being slotted at regular intervals for the purpose, the acute angle is inserted into its corresponding slot, the spring of the metal allowing it to pass through, but preventing its withdrawal.

Fig. 1.

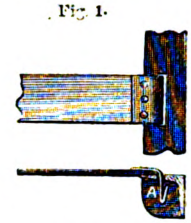
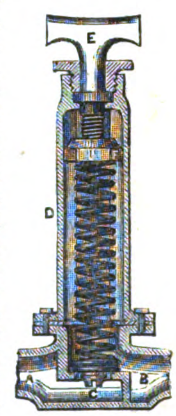


Fig. 2.

REGULATING PRESSURE TAP.

Registered for MR. D. SIMPSON, *Lancaster.*

Mr. Simpson's design, as its title perhaps indicates, like the two inventions of Messrs. Bryce* and Burges,† has for its object the relieving of the water service pipes of dwelling-houses, from the dangerous consequences of excessive internal pressure, more especially the excessive shocks arising from rapid closing of the stopcocks.

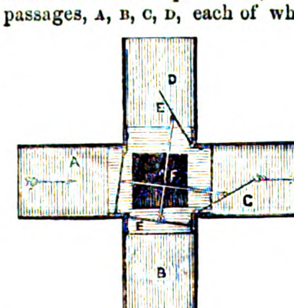


Our engraving represents the valve and vertical longitudinal section. The horizontal pipe, A B, is supposed to form a portion of a line of service pipe, or it may form the supply stopcock itself. The water enters at A from the main, and is compelled to pass through the valve, C, before it can flow off by the outlet end, B. The cylinder, D, which is bolted down upon the horizontal pipe, directly above the valve, C, contains the adjusting spindle, of which the handle, E, passes out through a stuffing-box at the top. The spindle passes through a nut, F, and beneath, it is encircled by a helix, which abuts between the nut and the valve, C. Thus, by turning the handle in either direction, the fluid pressure on the discharge side may be diminished to any required extent, just as in Mr. Burges' earlier plan, which, by the way, would seem to have afforded a copy for Mr. Simpson—not that he has followed it sufficiently closely, for a moment's comparison of the two plans will but add another example to the many existing cases of modification without improvement.

SMOKE-PREVENTING APPARATUS.

Registered for MR. C. N. MAY, *Engineer, Reading.*

The action of this apparatus resembles that of Mr. Syme's ingenious arrangement.‡ Our figure is a horizontal section of the preventor, which is cruciform, having four discharge passages, A, B, C, D, each of which is guarded by a flap-valve, E. The two opposite valves in each case are connected together by light hinged links, F, so that, whenever the wind blows in at an opening, it closes that valve and opens the one on the other side. In our figure, the wind is blowing in at A, and the closing of the corresponding valve has opened the opposite one in C. Similarly, the former closing of the passage, B, has opened D, so that, whilst the wind cannot interfere with the draught, the leeward side is open for the escape of the smoke from the chimney aperture in the centre. By continuing the discharge channels some distance out-



* Page 255, Vol. I. † Page 159, Vol. II.
‡ Page 199, Vol. I., P. M. Journal.

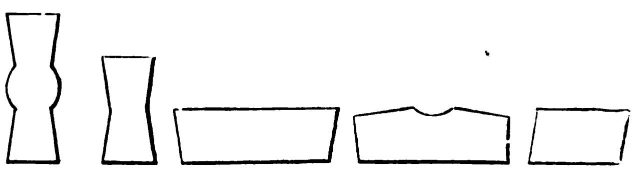
wards, the wind is prevented from entering when blowing obliquely on the valves. To assist the draught, a small hole is made in each valve to allow a slight current to pass rapidly across the chimney, and thus produce a partial vacuum, as in the blast-pipe of a locomotive. All chance of noise from the striking of the valves by the wind is obviated by the simple contrivance of a light chain, hung loosely, with one end fastened to the outside of the valve, and the other to the interior of the fixed discharge-passage. This gives a sluggish, elastic movement to the valves. The spindles on which the valves turn, each work between two centres outside the casing, so as to be out of the way of the stiffening effects of the smoke.

BRICKS FOR BRITISH BOND AND HOLLOW WALLS.

Registered for Mr. W. Austin, *Architect, Farnham, Surrey.*

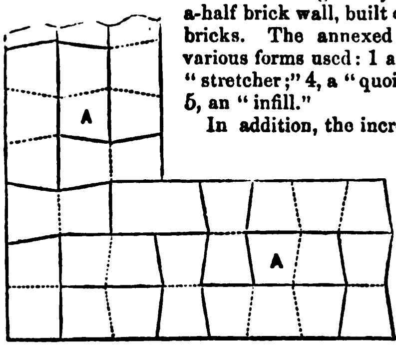
These bricks are intended to form what is termed "*British* Bond," in contradistinction to "*Old English*" and "*Flemish* Bond"—the "dove-

Fig. 1. 2. 3. 4. 5.



tail" being introduced, to secure the great binding power which this principle affords in connection of materials of every kind. The strength of a one-brick wall of the dovetailed bricks is calculated as being nearly equal to that of a one-and-a-half brick wall, built of the common rectangular bricks. The annexed diagrams represent the various forms used: 1 and 2 are "headers;" 3, a "stretcher;" 4, a "quoin or angle stretcher;" and 5, an "infill."

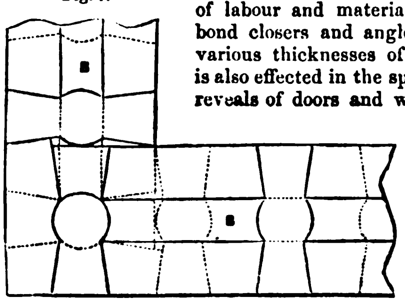
Fig. 6.



In addition, the increased strength thus obviously gained, opportunities are afforded, as shown by infill spaces, A, as indicated in the 1½ brick wall, fig. 6, of leaving cavities for the escape of damp in thick walls, by allowing a current of air to pass through vertically.

The stretcher, fig. 3, is firmly secured all ways, by the dovetailed headers, 1 and 2, as in the plan of the one-brick wall, fig. 7; and consequently, all cutting for "closers," and waste of labour and materials, is avoided, by having bond closers and angle quoins moulded for the various thicknesses of wall. An improvement is also effected in the splayed form given to outer reveals of doors and windows. The headers, 1, are intended for walls requiring a passage vertically for iron pipes, for heating purposes; the unoccupied cavities, B, act as air-channels, or they may be filled with grout, and form a strong continuous bond. The headers, 2, form an improved paving on flat, as also solid work for bridge piers in rivers, and in the backing up, or junction with stone ashlar faces.

Fig. 7.



REVIEWS OF NEW BOOKS.

On the Amendment of the Law and Practice of Letters Patent for Inventions. By Thomas Webster, Esq., M.A., F.R.S., Barrister-at-Law. 2d Edition. London: Chapman & Hall. 1852. Pp. 42.

The not extraordinary but significant fact to which Mr. Webster refers (p. 16), that the germ of nearly all modern improvements in the arts and manufactures of the country will be found to have been the subject of patents, or embodied in the specifications, points out with irresistible force the importance of inventions, and the great care which the Legislature should bestow upon them. Until lately, however, they have been as carefully neglected. For the highest education of the country, in regard to inventions, being as uninfluential as no education at all, it has necessarily followed, that for all the improvements in our arts and manufactures, the mass of the people are indebted, not to their rulers, who ought in some degree to be their teachers, but to the laborious and untiring efforts of individual inventors. The time has commenced when this state of things must, by the mere force of circumstances, lead to a better—somewhat more in accordance with the spirit of the days in which we live.

We are reminded, in this pamphlet, that an invention, the subject of letters patent, is "the working or making of any manner of new manufacture." We have nothing to say against this simple definition, except that there is a prime element in invention which it does not comprise, and might be difficult to make it comprise, namely, improvement on old processes. It is obvious that an invention is as much a private matter as it is of public interest. Originating in one person, he stands as the centre of an infinite circumference. He knows and feels that the result of his solitary thought and care—which the world would not have missed, but which he voluntarily gives—is the generation of a benefit, which, in some form or another, is to last for ever—when all of him besides is perished and forgotten, in this flowing down of the current of his mind into the broad ocean of humanity, he lives and sees himself in the distant time still, more or less, the benefactor of his species; and he feels that without him, without his personal exertions, the thing would not have been as it has been. On the other hand, stands the great world ready to grasp at and secure every good which is brought before it. It understands not monopoly; and, but for some ineradicable convictions, which it strives to smother, but cannot, associated as they are with the well-being of every individual of its multitude, would at once, without more ado, appropriate to itself the benefits demonstrated for the first time by the inventor. The interest of each is accordingly, when abstractedly considered, completely antagonistic. Every municipal state has, therefore, to frame a measure of justice between them, and common sense comes to the aid of the legislatures. It rightly judges that in every invention, although originality is due to the inventor, yet that originality consists of a minute matter after all; in other words, that the "work," or the "make," as improved by the inventor, is but as an apex placed upon the broad base of a pyramid, for the construction of which he has mainly been indebted to the world at large. The prime difficulty of legislation on the subject, is to adjust the benefit between the inventor and the world; the secondary difficulty is in the mode of carrying this into practice. Both difficulties are the subject of patent-law. The object of this law is "to give to the inventor as much, but no more than he is justly entitled to, and to restrain the public, that is, persons engaged in the same department of the arts and manufactures, in the free exercise of their knowledge, no more than may be necessary for the protection of the rights of the true and first inventor."

Mr. Webster comes forward and points out first the crying evils of the present system, which he enumerates in—"the want of protection until the actual sealing of the patent, the inadequacy of the tribunal of the law officers, the defects of the caveat system, the delay and obstruction to the progress of grants, the triplication of fees for the patents for the three countries, and the impossibility of obtaining information as to patents in progress, or granted and not specified." These matters prove that some efficient practical reform is needed.

It is unquestionably one of the most important duties of a State and people such as ours, to encourage invention by every possible means; for it is by such alone that humanity can be lifted out of the mechanical and necessarily confined, into the intellectual and necessarily free. If I substitute a mere material machine to perform any labour that my hands can perform, of course I set free for more elevated purposes that power which was absorbed in my attention during the process of my manual dexterity. Power, in its varying forms of capital, is economised, as it is called, but this term scarcely conveys the true import of what is thus done. The necessaries, comforts, and conveniences of life are set at large. Many are made to participate in those things which, with greater toil, were previously shared among the very few. It is the greater or less abundant dissemination of these matters which, in reality, establishes the difference in greatness and true empire between nations.

For remedying the existing defects of our patent law, the author proposes—1. Protection to the intended patentee from the time of application for the patent; 2. One patent for the United Kingdom; 3. Payment for the patent at two periods; and, 4. The establishment of indices to inventions, and publication and enrolment of the specifications. Upon

each of these he enters somewhat into detail, adducing many arguments to prove his positions. He suggests the formation of a competent tribunal for the preliminary examination of an application for a patent. Such tribunals, as some of our readers are, to their cost and trouble, aware, exist in many foreign States; and if the inconveniences found to lie in such Boards could be satisfactorily removed from any that we should be able to form, no doubt much general benefit would accrue, although, it might be, that in some particular instances, much vexation and injustice might ensue. On the subject of payment at two periods, we give Mr. Webster's remarks in full:—

"The opinion of inventors, patentees, and others interested in the subject, has been very strongly expressed in favour of a payment at two periods after the grant of the patent, the cost of the patent being reduced to a small amount. As, for instance, the patent for the United Kingdom to cost £20, and to expire at the end of three years and seven years respectively, unless further payments of £40 and £70 be made before the expiration of the third year and seventh year. Thus the right would be acquired at a comparatively small amount; the three years would be sufficient to enable a tolerably accurate opinion to be formed of the probable success of the invention, while the increasing payments of £40 and £70 would effectually secure the abandonment or lapsing of patents for inventions having no practical utility. Inventors and manufacturers would be able to form a tolerably accurate opinion as to the probability of the patent being kept in force, and be at the same time free from the great uncertainty attending any system of annual payments."

In addition to the fourth improvement suggested by the author, we would have periodical public exhibitions, at least in the three capitals, of expired patents in actual use; provision being made on the grant of a patent for models or actual machines for the purpose, being forthcoming in due time. Some summary mode of dealing with adjudged piracies and pirates is also demanded, but it seems early time to talk about this as yet. The truth is, that inventors must get, little by little, what they can, and wait a while until our legislators themselves shall become by education fully alive, which they cannot now be said to be, to the immense importance of due consideration of the subject. As it is, "useless forms are gradually being destroyed. By the Act of 14 and 15 Vict. c. 82, for simplifying the manner of passing grants under the Great Seal, which came into operation on the 1st of January last, three of the most useless stages were abolished." So far, so good. We are improving. The mere public official expenses of an English patent lately amounted to £94. 6s. They now amount to £76. 6s. Still much too high, increased as they necessarily are by the solicitor's fees, hardly earned in many cases of patent. The stamp should be abolished. It amounts to £30 for England or Ireland. Why should there be none for Scotland? or rather, why should there not be none for both the other portions of the United Kingdom? This is another instance of the bungling of our "masters" of finance.

Mr. Webster says—"The proceedings in Parliament during the Session of 1850, on the Copyright of Designs Amendment Bill, had given rise to an impression that the creation of exclusive privileges in respect of inventions, theretofore the subject of letters patent, was to be brought under the operation of a system analogous to the registration of designs in the arts and manufactures; or, in other words, that the two subjects of design and invention in the arts and manufactures were to be brought under one and the same system." We think that the suggestions which have been made to associate the two subjects of designs and inventions in some one mode of legislative treatment, are rather dictatorially ascribed by Mr. Webster to "inability to appreciate, or indisposition to attend to certain dissimilarities between them in their practical bearings." "No analogy or connection," he goes on to say, "exists between an invention and a design, except as creations resulting from the exercise of mind." But surely the true distinction appears to be in the manner. Design is superficial; invention, in all planes, so to speak. Indeed, Mr. Webster not only does not deny, but takes pains to state his opinion, that the *principle* of protection for literature, music, and the fine arts, and for invention in arts and manufactures, is the same in each case; the distinction which he would practically make is in the nature and extent of the protection, which he would have to vary with the peculiar subjects. We agree with the writer, that the experience of the working of "The Protection of Inventions Act, 1851, leads to the conclusion that the public exhibition of matured inventions, coupled with provisional protection for a limited time, will effect much towards checking the creation of invalid legal rights, and promoting the real interests of inventors, and the progress of invention."

What is called accident in this, as in other thousand matters, appears to have suggested improvements in this law, which, but for such fact, might not have been suggested. The "Protection of Inventions Act, 1851," which enabled inventors, who had not yet obtained their patents, or regularly registered their designs, to protect themselves provisionally, upon adding such inventions to the Great Exhibition, seems to have been this accident. It is due to Sir William Cubitt to state, that, in his evidence before the House of Lords, he appears to have been the first who proposed the establishment of a general means of provisional protection: an advantage likely to result in much lengthened benefit. No doubt, inventors would gladly pay for the privilege of depositing, exhibiting, and advertising their inventions in such a place of public exhibition, which would thus become "A Museum of Invention," and an institution of the nature of "An Inventor's Mart," "affording to the inventor an opportunity of negotiating with the capitalist, and to the capitalist the means of forming a just estimate of the value of any invention."

On the whole, we are inclined to agree with the author, that under the system he advocates, if properly administered, the poor and rich inventor would be placed on an equal footing, and an efficient practical check would be afforded to the unprofitable expenditure of time and money, and to the creation of legal rights of doubtful validity.

In our former notice of this little work, we designedly abstained from entering at any length into the subject. So expeditious a second edition has made it incumbent upon us now to go into it as fully as we have done. And the author will deserve the thanks of many more than ourselves, if some (if not all) of his suggestions shall be acted upon.

NOTES TOWARDS A SOLUTION OF THE SMOKE NUISANCE. By W. M. Buchanan. 8vo., Pp. 56. London: Griffin & Co. 1852.

"Never start till you are ready," says Jonathan. The advice emphatically applies to the consumers of coal, and to those who usually undertake to advise them. The complicated problem of smokeless combustion under steam-boilers has never, so far as we know, been fairly probed to the core, notwithstanding the legion of patent panaceas which have successively been offered to the public for mitigating the imperfect action of steam-boiler furnaces. It is usual to assume very simple chemical conditions of combustion in the coal-furnace, by regarding only the simplest combinations of carbon and hydrogen, carburetted and bicarburetted hydrogen, as those which chiefly come into play during the primary and more complicated stages of combustion. This view of the subject is not warranted by the facts of the case. On the contrary, it has been abundantly established, that the immediate products of the destructive distillation of coal, to which process every fresh charge of coal is subjected in the furnace, comprise many chemical combinations of carbon and hydrogen; and it is precisely to the circumstances under which these varieties are generated, the practical difficulties in the way of their complete combustion, and the means of meeting these difficulties in the most direct manner, that Mr. Buchanan, in the pamphlet before us, has devoted his attention. Free of the pedantry which has led some writers on the combustion of coal to speculate, with magniloquent verbosity, on the chemical relations of its very simplest elements, and from the affectation with which others have adhered to their "Practical Notes," alike incapable and indisposed to reduce this matter to its ultimate principles—Mr. Buchanan has contributed a series of "Notes," which form the most pertinent and original exposition of the vexed question of coal-combustion that has come under our notice.

Coal is composed chiefly of carbon and hydrogen, and Mr. Buchanan lays down the fundamental proposition, that hydrogen gas, "the most perfect type of gaseity which chemistry has discovered, is really the cause of all those difficulties which stand between us and the coveted desideratum of a smokeless furnace;" because, he adds, "coke and anthracite give no smoke during combustion, although composed of the very matter of smoke—of almost pure carbon; and it follows that the property of smoke-making is in some way connected with the presence of hydrogen, the gaseous element of the coal." A few words indicate the nature of this interference,—"the hydrogen element possesses the higher combining power; its affinity for oxygen is greater than that of the carbon element, and, in consequence, its combustion takes precedence." On this fact rests, in great part, the onus of smoke-nuisance.

When coal is completely burnt with atmospheric air, combustion takes place between the oxygen of the air and the carbon and hydrogen of the coal, forming the products—carbonic acid and water. In the formation of this water there is no practical difficulty, as the hydrogen must, first of all, be served with oxygen, and the two elements combine in the simplest possible chemical proportions. Not so simple is the combustion of the carbon; for besides having to wait its chance of the oxygen not used by the hydrogen, it is susceptible of chemical union with oxygen in two proportions, forming carbonic oxide and carbonic acid, of which the latter contains twice the quantity of oxygen in the former for a given weight of carbon. In the formation of the oxide, the carbon is said to be imperfectly burnt, not merely because it unites with an inferior proportion of oxygen, but, what is of real importance, because it develops not one-third of the heat yielded in the formation of carbonic acid. But much of the carbon may not even have the opportunity of

becoming an oxide, and may pass off entirely unburnt, as sooty matter. It does so in fact, and constitutes the opaque or colouring matter of the smoke which lugubriously rolls forth from the factory chimney.

Green coal, on being thrown into the furnace, and subjected to the heat of previously ignited coal, distils into a great variety of hydro-carbon compounds, if not simultaneously, at least in close succession, regulated by the rise of temperature by combustion. These consist of oils and resins, vaporised at very low temperatures, and the more volatile oils—naphtha and its modifications, olefiant gas, and carburetted hydrogen. The higher the temperature, the less carbon is raised in union with the hydrogen, and the earlier hydro-carbons mainly constitute the smoke-making part of the coal, for it is just when the temperature of the furnace is lowest that the carbon *is most rapidly gasified and removed.* A high temperature is essential to complete combustion: the higher the temperature, the less is the excess of air necessary, for the more active are the affinities on which the combustion depends; and hence the cooling influence of the boiler is adverse to this object. But a rise of temperature, unaccompanied by an increased supply of air, tends also to the formation of smoke, as the heavier hydro-carbons spontaneously assume the lighter forms, and set free a proportion of their carbon as smoke. Again, even though carbonic acid may be formed when the air first enters the mass of fuel, it will, if it be allowed to remain too long in contact with the fuel, be reconverted into the oxide, of very inferior heating power. There is also the difficulty of effecting the union of oxygen with the combustible, when diluted beyond certain moderate limits with carbonic acid and nitrogen. Smoke is caused also by the formation of ammonia, by which the hydrogen is abstracted to combine with nitrogen, and the carbon is precipitated.

From this imperfect sketch of the points insisted on by Mr. Buchanan, it will be seen that he takes account of the real difficulties of the problem. He concludes, that not only must there be provision for burning the smoke, but the permanent formation of carbonic oxide must be prevented. A slow draught gives time for the conversion of the acid into the oxide; he would therefore reduce the loss by oxide, by reducing the depth of fuel on the grate, or by more active draught, which allows shorter time for the conversion of the gas; or, otherwise, he would admit as much air to the furnace *above* the fuel, or beyond it, as would reburn the oxide, and reduce it to the primitive acid. To unite all the requirements for complete combustion, he concludes generally—1st. That oxygen must be present in sufficient quantity to saturate the combustible elements; and, 2d. That the temperature must be sufficiently high to favour the combination. Neither condition is alone sufficient; both together are necessary. Besides making the combustion more perfect, a high temperature requires less excess of air. From these conclusions, Mr. Buchanan legitimately argues that the one practical condition, necessary and sufficient for the prevention of smoke, is a brisk draught—a conclusion which we shall give in the author's own language:—

"When a furnace is worked to the limits of its capability, it is therefore scarcely possible that the fireman can so manage it as wholly to avoid the production of smoke. He does not usually make the attempt; but this negligence is not a present question; meantime we consider merely whether or not the facility exists for accomplishing the end. We conclude that the problem is possible—just possible; and that, if a furnace could be managed with the same precision as a laboratory experiment, and the fireman was professedly versant in the chemistry of combustion, no excuse for smoke, in the circumstances of the case, ought to be accepted.

The inverse case is still more difficult to deal with—that in which, contrary to much received opinion, the furnace capacity is inordinately in excess. The one practical condition, necessary and sufficient for the prevention of smoke, is a brisk draught—a draught sufficient to bring the necessary supply of oxygen into contact with the volatile matters of the coal immediately on their liberation, and to afford, by its mechanical action, an effective compensation for imperfect diffusion of the active gases. It is thus only that the hydro-carbon vapours can be completely burned, and smoke prevented. But a brisk draught implies a correspondingly quick rate of combustion, and, in consequence, a high temperature in the furnace, and rapid production of steam in the boiler. Accordingly, when the demand for steam is less than admits of the necessary draught and consequent rate of combustion in the furnace, the production of smoke is absolutely unavoidable, if any regard at all is had to economy of fuel.

"The difficulty is very palpable. If the quantity of steam required can be produced by a languid rate of combustion and sluggish draught, the temperature in the furnace is correspondingly low, and insufficient to communicate the necessary activity to the combining gases; or, more correctly, the heat is not enough to sustain the temperature of the carbon element after separation, and promote its union with the oxygen, even should the condition of diffusion in absence of draught be complete. In proper action, this union ought indeed to take place immediately on separation of the carbon from its combination, by combustion of the hydrogen element, and while it still retains the high temperature it then receives. Its combining power is then more intense than it probably ever after can attain; for its temperature cannot, under the circumstances, rise higher; it is then a maximum. It is this more or less rapid oxidation of the carbon element that determines the colour of all hydro-carbon flames; they are vivid in proportion as the combustion is rapid; and the combustion is rapid in proportion as the saturating element, the oxygen, is more or less rapidly supplied. The flame-heat of an open gas-jet is entirely expended in this process—in feeding itself with oxygen by means of the ascending current, the draught it creates in the mass of air immediately around it. But let this aerial current be impeded in any way, as by a hollow cone held over the jet, and the flame immediately becomes larger and less intense; for the body of combustible gas must diffuse itself into the surrounding air, and thereby present a larger circumference, in order that it may find the requisite supply of oxygen; and in consequence of this increase of volume, the temperature of the flame is correspondingly lower, and its light less brilliant. If the air-current is still further obstructed, a portion of the carbon is deposited, and the flame smokes; not because air is wanting, but because that immediately in contact with the flame has been robbed of its oxygen, rarefied, and rendered partially stagnant; and all this because the draught which the flame naturally makes for itself is impaired.

"The effect of draught is virtually, in fact, to increase the combining power of the saturating constituent, the oxygen of the air, not only by continually bringing fresh portions of it into contiguity with the body of combustible matter, but further by impelling it into contact with the combustible before the air has absorbed heat and expanded. And this is especially true when the combustible is in the gaseous form; for as the oxygen is rapidly supplied, the flame is the smaller, the more concentrated, and therefore the more intense; and in consequence of this exalted temperature, and the influence it exerts on the combining elements, the combustion is the more complete with a given minimum supply of air."

Having unconditionally condemned the languid circulation of the air in the furnace as a condition of perfect combustion, contrary to much authority, and advocated a greater rate of combustion, our author finds that furnaces having grate-area in excess cannot possibly be economical with ordinary coal, and that the relation of the area of grate-surface to the quantity and quality of the coal to be burned, is among the very first points that ought to receive attention:—

"The only circumstances in which the fireman is without excuse for producing smoke, are those in which the furnace-capacity is abundant, but only a little in excess; where the demand for steam requires the maintenance of a brisk rate of combustion, but does not produce the incessant and anxious urging of the fire, which is more and more felt to be necessary as the limit of capability is approached. Enough has already been said to render it plain, that the conditions are then the most favourable, as they combine with the high temperature necessarily kept up in the furnace, a facility of admitting an extra supply of air during the earlier states of the fire, without that dread of excess which haunts the fireman in charge of a furnace required to be worked to its limit. This implies, of course, some waste of fuel by the excess of air, which we supposed to be admitted to the furnace during the distillation of the coal; but, with ordinary management, this waste is more than compensated for by the more complete combustion of the volatile products of the coal."

While Mr. Buchanan advocates the necessity and general sufficiency of an active draught, he admits the necessity also of supplying an extra quantity of air by the fire-door immediately after each charge of fuel, during the critical periods of combustion. The proper amount of opening every fireman must discover for himself, and learn besides to diminish it gradually as the distillation proceeds:—

"These are the points he must keep steadily in view, and to which his whole attention and manipulation must have reference. It is not forgotten that the conditions imply more energy, more intelligence, more skill and perseverance, than firemen ordinarily possess; altogether more than they are usually expected to possess, and their duties to demand. The fact is beyond controversy, and no doubt significant, but altogether beside the object of these explanations; which prefer no claim to the merit of "making firing easy," or of bringing down the art to the level of the "meanest capacity." The purpose has been to point out the conditions that it is necessary and sufficient to fulfil, in order that smoke-nuisance may cease; in what circumstances the entire avoidance of the evil is possible; and where and when its abatement falls within the *possible* and beyond the *practicable*. And even if these pages go no further than to make it appear that good firing and skilful firemen are necessary for the mitigation of the nuisance, and are at the same time conducive to economy, if they lead to the conclusion that firemen ought to stand on a higher level than mere labourers, they will not have been written in vain."

We must congratulate Mr. Buchanan upon his free and independent treatment of the question before us. It is one of those on which a vast deal of attenuated stuff has been written; and to such as are familiar with the ordinary literature of the subject, we can recommend this well-written pamphlet as an example of original philosophical discussion, tempered with that consideration for practical necessities which can never be disregarded with impunity.

Tables for Facilitating Calculations of Cuttings and Embankments, &c. By James Henderson, C.E. 8vo., Pp. 29. Woodcuts. London: Simpkins & Marshall.

The best introduction which we can give to Mr. Henderson's useful little work, is a transcript from his own preface. In it he tells us that—

"The tables are suitable for computing the contents of cuttings and embankments, in cubic yards, for roads, railways, canals, new courses for streams and rivers, reservoirs, drains, &c., the original surface of the ground, longitudinally and transversely, being level, or having regular or irregular inclinations, and are so arranged that they can be applied for calculating the contents for final measurements, or for obtaining only an approximation.

"The principal feature in the construction of tables Nos. 1 and 2 consists in the application of a new formula for calculating the sides or pyramidal parts of cuttings and embankments. The formula at present generally in use is $\frac{1}{3}(a^2 + ab + b^2)$ L, a and b being the height or depth of cutting or embankment at each end, and L the length. The formula adopted for these tables is $(H^2 + \frac{1}{12} D^2)$ L, H being the mean height or depth, and D the difference of heights or depths. In tables computed from the former formula, separate quantities require to be given for every variation of a and b; but with the latter, by the arrangement followed out, one quantity only is necessary for all heights or depths having the same mean, and one for all heights or depths having the same difference. These tables thus possess the advantage of being rendered very comprehensive within a very limited space, while they are at the same time extremely simple and easily applied to practice. To carry out a table for the pyramidal or side parts of cuttings and embankments based on the old formula, for every tenth of a foot of height or depth from one-tenth up to fifty feet, upwards of 125,000 different quantities are required, but, by means of the new formula, the whole can be comprised within 1000.

"Table No. 3 will be found extremely useful for calculating the contents of cuttings and embankments, when the transverse section of the original surface of the ground has regular or irregular inclinations. It is arranged so as to be suitable for various slopes of banks of said cuttings and embankments.

"For the lengths in tables Nos. 1 and 2, the imperial chain has been adopted, but, in cases where they are measured with the hundred feet chain, the total contents can easily be obtained by the proportion 66 to 100."

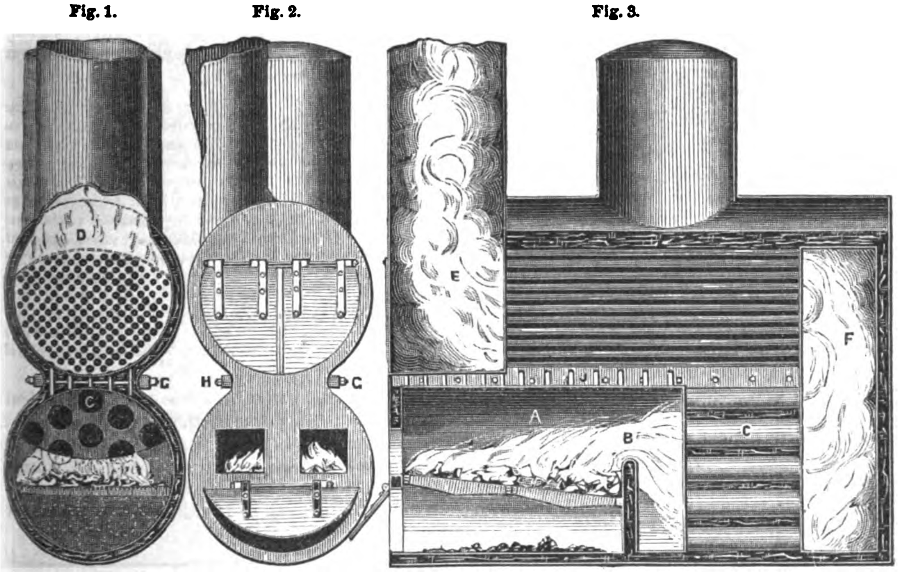
This improvement in the principle of construction of the tables is very obvious; and on the part of the profession, we are glad to be able to accord to the author, our thanks for so clear an analysis of his subject. We are not left to hunt about for a clue to his meaning, or a translation of his terms; neither are we mystified in the labyrinth of figures so common in books professing to be ready guides, and which, like *Bradshaw*, would be all the better of an accompanying key. The several columns, with their accompanying body text references, are distinctly identified by bold and striking characters. In its constructive details, the book is a model of arrangement.

CORRESPONDENCE.

DUPLEX HIGH-PRESSURE MARINE BOILER.

As the pages of the *Practical Mechanic's Journal* are evidence that you constantly receive and attend to suggestions and notions from all quarters of the world, I trust that a few words about boilers, illustrated by a sketch of a new steam-generator of my own, will not be denied the benefit of your examination.

Fig. 1. Fig. 2. Fig. 3.



Up to the present moment, the practice is still to persevere in the use of low-pressure boilers, more especially for steam navigation, although every one at all acquainted with steam-engines is perfectly well aware of the economy resulting from the expansive action of high-pressure steam.

For stationary purposes, it is true, high-pressure engines are, now-a-days, very commonly used; but, in such cases, the rule as to the velocity of the piston is the same as in the dark ages of low pressure. This is altogether wrong—for the higher the pressure, the greater the velocity of the steam; and therefore, if a piston is worked advantageously at the rate of 240 feet per minute, by steam of 10 lbs. pressure, it must be clear that the same conditions are quite unfitted for a steam pressure of 60 lbs. It is reasonable enough to urge the necessity of proportioning the rate of piston to the increased velocity of steam due to the higher pressure; and hence all velocities of piston ought to have their corresponding relative steam pressures. If we adhere to this rule, we shall clearly see that all wheels and additional gearing connections for getting up a high speed, as for the screw-propeller—however stoutly their use may be advocated on some hands—are useless and inconvenient appendages.

The general, but very false, notion that high-pressure boilers cannot be made as safe as low-pressure ones, is, in a great measure, the cause of the dull progress of steam navigation; and this feeling has, no doubt, received further effect from the reality of the want of an efficient and trustworthy high-pressure boiler. With this preface, I may introduce my arrangement of boiler, which I propose as a means of removing all excuse for the discouragement of the employment of high-pressure steam.

High-pressure boilers must be cylindrical, as the shape giving the greatest strength, bearing in mind, also, that the smaller the diameter, the more the boiler will stand; but to work a powerful engine, in a steam-vessel for instance, with boilers of very small diameter, would involve excessive inconvenience, owing to the number required, and the consequent complexity of their connections, more especially if each boiler had its own internal fire. These objections are removed in my plan.

Fig. 1 is a transverse section of the boiler when single; fig. 2 is an external end elevation corresponding, showing the arrangement, as it would be with two boilers combined; and fig. 3 is a longitudinal section. It consists of two cylindrical vessels set parallel, and one above the other. The lower one contains the fire-box, A; bridge, B; and main flues, C, if any are used; whilst the upper one has in it the return-flues, D, the steam-room and smoke-box, E. The upper and lower flues are brought into communication by the vertical connection, F, behind. The upper and lower sections are not entire cylinders, a segment, as it were, of each being cut off throughout the length of both; the corresponding edges of the two, when set together, being bent outwards, and riveted to each other, so that a free passage is formed for the steam and water to pass from one to the other. To resist internal pressure at the junction of the two sections, a strong iron bar, G, is laid along the whole length of both external cavities, being retained by transverse bolts, H, passing through the boiler. In this plan, as all the interior and exterior surfaces are of a cylindrical form, or nearly so, great advantages are presented in it in point of strength; and those inside parts which cannot be bolted to the outside—as, for instance, the top of the back connection and part of the fire-box—are strengthened by bars, J, just as in the tops of locomotive fire-boxes. It is obvious that this boiler presents an unusually large area of heating surface in comparison with its size. It is not so overloaded with a heavy burden of water, as in most other boilers, and it presents great facilities for arrangement in the vessel. The steam-room is somewhat small; but, if high-pressure steam is worked expansively, as it ought to be, the space which I have allotted for steam will be quite sufficient in comparison with the quantity exhausted into the cylinder at each stroke.

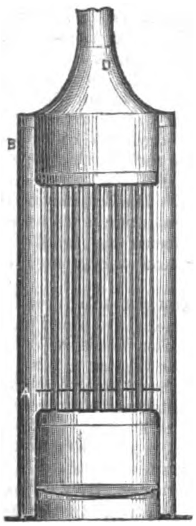
E. A. Bourry, C.E., Suisse.

New York, April, 1852.

VERTICAL TUBULAR BOILERS.

Permit me to lay before your readers a few ideas that have occurred to me since witnessing the utter failure of one of these boilers in its application to a locomotive. It was of the same construction as the one used in "Trevithick's Coal-whipping Engine," in your plate 95 of last month, except that the bottom tube-plate was flat, and there was no water-space beneath the fire. He found the objections to consist in the collection of the sediment on the bottom tube-plate, causing the metal

to burn; the loss of heating surface from the upper portions of the tubes being out of the water, and the overheating of the smoke-box door, to which, I think, may be added the danger arising from the presence of surcharged steam. In my arrangement, as here sketched, I have endeavoured to keep the sediment off the tube-plate, by putting in a plate at A, drilled so as nearly to fit the tubes which it encircles individually, and supported on three brackets riveted to the boiler. A blow-off cock is to be placed opposite the edge of this plate, and another above the ring at the bottom of the fire-box. The whole of the tubes in this boiler are under water, as I have provided an annular steam-chamber at B, on one side of which a steam-dome may be put, if necessary.



By the use of the inside cone, D, in the chimney, which is only fastened to it by a few round stays, the whole of the heat will be available for draught after it leaves the tubes, and the blast-pipe need not be so much contracted, leaving the engine less fettered by back pressure. A good upright boiler is now a subject of considerable importance, and I think many of your readers would be glad to see some good examples in your pages.

J. D. HUMPHREYS.

London, April, 1852.

[We shall be glad to avail ourselves of the experience of any of our correspondents, who may have good examples of boilers of this class at their command.—ED. P. M. JOURNAL.]

RAILWAY COLLISION PREVENTION APPARATUS.

With your permission I beg to lay before the readers of the *Practical Mechanic's Journal*, a plan for the prevention of collisions on railways, more especially in tunnels. At some distance outside the mouth or entrance of the tunnel, I would place a vertical post, with a projecting arm standing out as far as the outer line of rail, but at such a height as not to interfere with the tops of the carriages. Then, from this arm, a wire is passed through the tunnel to a corresponding arrangement outside the other end of the tunnel, the intermediate length of wire being carried by a series of similar arms erected at suitable distances apart. The end of the wire is coiled up to form an electro-magnet, and is connected to clock-work to enable it to ring a bell when necessary; thence the wire is conducted back to the other mouth of the tunnel, for connection to another and similar arrangement for ringing a bell; finally, it is passed into the earth. At each post the wire is passed through insulators, just as in the regular line-wires of the ordinary telegraph, but instead of being tightly stretched as they are, it is allowed to droop slightly. The starting end of the wire is to be perfectly insulated, so that only one end is in connection with the earth.

Each engine running on the line carries a galvanic battery, one end of which is connected with one of the axles, and the other with an insulated metallic rod, projecting from one side of the engine, at such a height that, when the latter is passing the suspended wire in the tunnel, the rod may clear the arms, but run along beneath, and slightly elevate the drooping wire by its pressure from beneath. This has the effect of completing the galvanic circuit, bringing the electro-magnet into action, and setting the bells a-ringing at each end of the tunnel.

With this plan in action, no engine could enter the tunnel without first ringing both bells; and, by extending the wire to a sufficient distance beyond each end of the tunnel, the bells would continue ringing until the train had entirely emerged from the tunnel at the other end. But the bells would not indicate the direction of the train's motion. This tell-tale must be provided for by using the arrangement which I have described, in duplicate—the two, however, being set in reverse directions, when bells of different tones will at once indicate the direction and position of the passing trains.

The second wire should be suspended from a second set of arms attached to the same posts as the first, but placed at some distance above them, the engines having each a second metal rod, in connection with the same end of the battery as the first rod, but projecting from the opposite side of the engine, and high enough to reach the upper line of wire. What I have described refers to a single line of rails; of course, with a double line, the whole details must be doubled, and fitted with four different-toned bells. The position of the wires liable to friction must be pretty thick, but the rest may be the ordinary telegraph wire, and must be coated with gutta percha to protect them from the damp of the tunnel, being either carried on posts, or beneath the earth's surface.

This might also be carried out along an entire line of railway, by fixing posts along each line, with separate wires and bells to each, at certain distances asunder—say as far as a bell can be heard in stormy weather. Such a plan, properly carried out, would enable the engine-driver to ascertain, both by day and night, what was going on either on his own or the other line of rails.

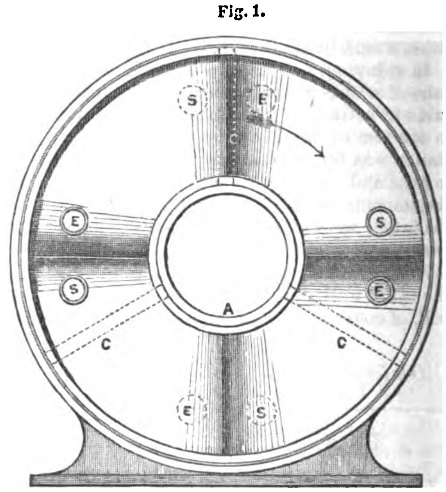
M. T. H.

Douglas, Isle of Man, April, 1852.

DANISH ROTATORY ENGINE OF CONTINUOUS ACTION.

The *Practical Mechanic's Journal* has at various times given to the world examples of, and suggestions for, rotatory steam engines, and to this series I now beg your permission to add one of my own, which I constructed some time ago. In my sketches, fig. 1 is a side elevation of the engine as it stands in working; fig. 2 is a plan; and fig. 3 a horizontal section through the centre of motion.

Fig. 1.



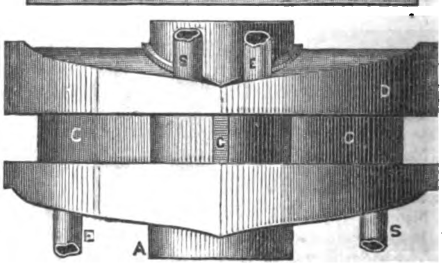
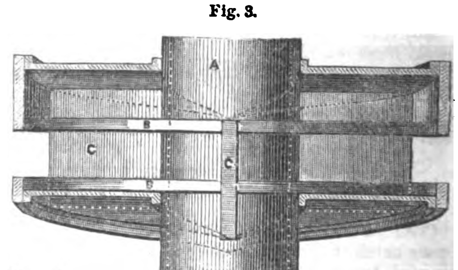


Fig. 2.

It consists of a rotating cylinder, A, with two plates, B, cast round it, in which are openings for the three pistons, C. These pistons have a lateral motion as they revolve with the cylinder plates, this motion being caused by the inclined ends of the outer cylinder, D. By this contrivance, the full surface of two pistons is constantly exposed to the steam pressure — because, when the area decreases on one side of the plates, B, it is always correspondingly increased on the other, thus securing a perfectly uniform motion. Shut-off valves are quite unnecessary for the regulation of the steam admission, as the communication between the steam and exhaust pipes—marked respectively S and E—is always closed when three pistons are used, as in the example I have given. Two pistons will obviously answer all purposes when the steam is worked expansively with valves.

Fig. 3.



C. W. H.

Copenhagen, April, 1852.

FLEXIBLE TUBE LEVEL.

I have recently constructed a simple instrument as a substitute for the ordinary costly telescopic level, which I find to answer well in actual practice. It consists of a gutta-percha or vulcanized india-rubber tube,

half an inch in diameter, and 50 or 60 feet long, and having fitted to each end a glass tube, like a barometer tube. The tubes are of course sustained in a vertical position, with a wooden case protecting three sides—the fourth being exposed, to show the level of the fluid with which the whole is filled. The tubes are kept in true vertical position by suspension from a universal joint, a weight being attached to the bottom of the wooden case. Along the edge of the glass, or its surrounding case, is placed the index, the graduations reading up and down from a central zero. To prepare the instrument for work, the glass tubes are set on the same level, and the indicating fluid—water tinged with carmine or indigo—is poured in, until it stands at the zero of the tubes. Then, on advancing over hilly or uneven ground, with one glass tube and index, the index will show a rise in one tube, while a corresponding depression takes place in the other—the difference of level being at once ascertained, by adding the two numbers, as read from the indices, together; or, what would be an elegant improvement, the two tubes might be bored out to precisely the same internal diameter; so that, by marking each of the index divisions with a number double its real value, the result would be obtained at once at either end; and thus the leader and follower, by keeping a register of the elevations or depressions, would be able to check each other most accurately.

In going over a road, the advance becomes nearly continuous, as two pairs of wheels are then used, having universal joints, to carry the glass tubes by. In levelling along a road in this way, two boys are necessary, in addition to the assistants—one to mark the point where the forward station was taken, stopping there until the follower reaches it; the other to raise and carry the flexible tube off the ground, alternately marking the stopping points, and carrying the tube. On hilly and broken ground, the leader and follower must take the lead in turns, the leader stopping when at the full extent of the tube, until the follower executes a similar movement. In either case, road or no road, it is believed that double the usual work may be done in any given time; whilst the instrument will, of course, act in any kind of weather—clear or foggy, wet or dry.

J. B.

Dunfermline, April, 1852.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

[*From want of space, we are obliged to omit, this Month, our usual Reports*

SOCIETY OF ARTS.

The following are the remaining Lectures on the Results of the Great Exhibition, proposed to be delivered in the Society's Rooms, during the present month —

May 5.—Henry Forbes, Esq. of Bradford: "The rise, progress, and present state of the Worsted, Alpaca, and Mohair Manufactures of England."

May 12.— ——— "Ceramic Manufacture; China, Porcelain, Earthenware," &c.

May 19.—Professor D. J. Ansted, M.A., F.R.S.: "Iron-metallic Mineral Manufactures."

May 26.—Henry Cole, Esq., C.B.: "The International Results of the Exhibition."

It has been intimated, as possible, that the above order may not be adhered to.

The following extra meetings are appointed to be held during the remainder of the Session:—

May 6.—"On the Musical Department of the Great Exhibition; and on Music as a social and moral agent, and in its relations to Commerce and Manufactures;" by the Rev. W. W. Cazalet, M. A.

May 13.—"On the Artificial Breeding and Rearing of Fish; and on the methods to be adopted to improve the Fisheries of the Country;" by Mr. G. Boccius.

May 20.—"The Theory of Circular Vision and Perspective;" by William Gawin Herdman, Esq., of Everton, Member of the Liverpool Academy of Arts.

May 27.—"On the Cultivation and Manufacture of Indigo in Bengal, on the production of Sugar from the Wild Date Tree, and on Indian Agriculture in general;" by C. H. Blake, Esq., late of Bengal.

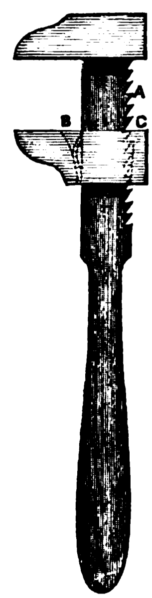
MONTHLY NOTES.

COST OF LOCOMOTIVE POWER.—During the last half-year the locomotive power on the Caledonian Railway has cost, for passenger trains, 6·66d. per mile; for goods trains, 9·47d.; and for mineral trains, 7·20d.; the average being 7·61d. per mile run, against 8·47d. during the preceding half-year. The expense of locomotive power and carriage stock averages 9·78d. per mile, against 10·90d. at the corresponding period of the preceding year. The number of miles run with passenger trains amounts to 473,691; with goods, 296,232; and with minerals, 251,499; total, 1,021,422 miles. The number of miles run by pilot engines was 95,352. The average number of engines in working order during the half-year is 107, and under repair 17. The average number of carriages in passenger trains 7, and of waggons in goods trains 24·47. The working stock consists of 73 passenger engines, 51 goods engines, 58 first class carriages, 76 second class, 108 third class, 19 composite, 2 saloons, 6 post-offices, 18 luggage vans, 15 carriage trucks, 15 horse boxes, 17 break waggons, 900 ordinary waggons, 52 coke, 20 covered and 152 cattle waggons, 10 fish vans, 10 sheep waggons, 3,200 mineral waggons, and 2 ale waggons.

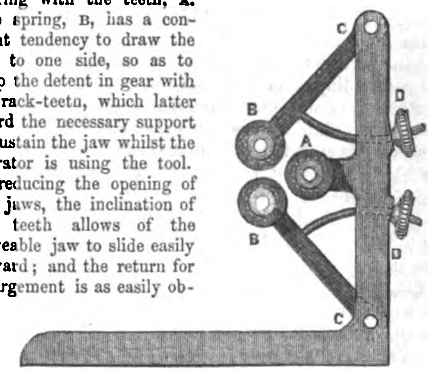
THE STEAM FRIGATE 'BIRKENHEAD.'—The following are the dimensions of this unfortunate vessel:—Length, 210 feet; beam, 37 feet 6 inches. She was fitted with engines of 564 horse power, by Messrs. G. Forrester & Co. She was divided into eight water-tight compartments, by bulkheads athwart-ship; and the engine-room was subdivided by two longitudinal bulkheads into four additional compartments, forming the coal-bunkers; making in all twelve water-tight sections. The first blow the vessel received (as described by survivors), ripped open the compartment between the engine-room and forepeak, and the next blow stove in the bilge of the vessel in the engine-room; thus filling the two largest compartments in the vessel in four or five minutes after she struck. The buoyancy of the after part gave time to get the boats out, by which the few survivors were saved. Had she been a wooden vessel, or not built in compartments, she would most likely have gone down in five minutes after she struck, instead of remaining afloat fifteen minutes.

SPEED OF THE DUBLIN AND HOLYHEAD STEAM PACKETS.—Since the contract with the City of Dublin Company in 1850, nine vessels have served in the conveyance of the mails between Dublin and Holyhead. This fleet is well known to have comprised the fastest vessels afloat. We have already given a tabulated statement of the dimensions and performances of four of them,* and we now add an epitome of the runs of the entire fleet. The distance between the two ports is 64 miles. The *Banshee*, 4 hours 7 minutes; the *Prince Arthur*, 4 hours 25 minutes; the *Eblana*, 4 hours 39 minutes; the *Llewellyn*, 4 hours 40 minutes; the *Caradoc*, 4 hours 40 minutes; the *St. Columba*, 4 hours 50 minutes; the *Iron Duke*, 5 hours 12 minutes; the *Windsor*, 5 hours 15 minutes; and the *Duchess of Kent*, 5 hours 15 minutes. The *Banshee* made the shortest passage between port and port, which was accomplished in the month of September, 1848, in 3 hours and 44 minutes. This vessel and the *Caradoc* are now employed in the Mediterranean mail service. The *Eblana* and *Llewellyn* are on a par, the former having made 661 trips, with an average of 4 hours 39 minutes; and the latter 694 trips in 4 hours 40 minutes. The fastest vessel on the line now is the *Prince Arthur*.

WORKSHOP ECONOMICS—LAWRENCE'S SCREW-KEY AND LATHE-BEARING.—Mr. Ishmael Lawrence, a wheelwright, of North Curry, Somerset, proposes the annexed form of screw-key as a useful simplification, both as regards construction and use. The square portion of the lever on which the sliding jaw traverses, has a line of ratchet or inclined teeth, A, formed upon it, and a cavity in the sliding jaw is fitted with a slight spring, B, whilst the opposite side, C, has a single catch or fixed detent for gearing with the teeth, A.



The spring, B, has a constant tendency to draw the jaw to one side, so as to keep the detent in gear with the rack-teeth, which latter afford the necessary support to sustain the jaw whilst the operator is using the tool. In reducing the opening of the jaws, the inclination of the teeth allows of the moveable jaw to slide easily forward; and the return for enlargement is as easily obtained by a slight pressure on the spring, to permit the disengagement of the detent and teeth. The second sketch shows his contrivance for use as a "lathe-bearing," the object being the steadying and supporting slender articles whilst being turned in the lathe. A small centre roller, A, is carried on a fixed bearing, projecting from an upright bar, whilst two other similar rollers, B, B, are respectively adjusted to revolve on centres carried in the loose ends of adjustable arms, hinged to the upright at C, C. These arms are fitted with curved screws, worked by thumb-nuts, D; so that the rollers, B, may be set at any required distance from the centre roller, A, to encircle the article to be turned. In turning a long spindle of small diameter, the whole apparatus, of course, travels with the slide-rest, so as to act close up to the cut.



IRON STEAMBOAT BUILDING AT LIVERPOOL.—Messrs. Thomas Vernon and Son have received orders for ten iron steamers, to be constructed with all possible despatch. They are, together with twenty more, to be built at the Clyde and Newcastle, for the Danube Steam Navigation Company. They will be sent out in sections, to be put together on their arrival abroad. They will be 176 feet long, with 25 feet beam, and drawing 9 feet of water, being constructed to carry very large cargoes with little draught, so as to navigate the shallow Danube. From the yard of the same firm has just been launched, the first of a new fleet of iron screw steamers, intended to carry coal from Hartlepool to London. It is expected they will open up a new and extensive trade, giving, if successful, an outlet for the larger quantities of coal in Northumberland and Durham, at the same time supplying

* Page 215, Vol. IV.

the inhabitants of the metropolis on cheaper terms than at present. They will be first-class boats, of full power, and rigged similarly to common merchantmen. They will be 160 feet long, 25 feet 6 inches beam, 80 horse power, and 500 tons burden. They will have double iron bottoms, which, besides giving extra strength, will enable them to employ water-ballast on their return to Hartlepool without cargo, avoiding the expense and delay attending other ballast. The one just completed will carry about 600 tons of coal, with 12 feet 6 inches draught of water, and her mast and funnel can be lowered, enabling her to pass the bridges on the Thames. Her propeller and engines are by Messrs. James Watt & Co. of Birmingham, the former being of the proportions shown by experience to give the best results. She is expected to go at the rate of seven to eight knots an hour, with full cargo. She, with the second of the fleet, the building of which has already commenced, are after the designs of Mr. John Grantham, consulting mechanical engineer. Messrs. Vernon are also building another iron steamer, to carry passengers and general merchandise between Liverpool and Newry; and they will shortly commence three screw steamers for the Mediterranean, to be of very fine lines, and expected to attain a very high speed.

Gas-heated Plates a Substitute for Fires.—At the Polytechnic Institution may now be seen a curious and ingenious plan for heating apartments, without the usual open fire-places or stoves. The invention, the joint production of Dr. Bachhoffner and Mr. Defries, consists in the substitution of thin pieces of metal in the place of coals in firegrates, which being acted upon by a small jet of gas, immediately become red hot, and emit great heat, the flame which is produced by the gas, co-operating with the metallic laminæ, gives the appearance of a brisk and cheerful coal fire, and can carcely be distinguished from it. There is no deposit of soot, no smoke, nor any of the annoyances which attend coal fires, and the gas can be extinguished at once, or the fire kept as low as may be convenient. It will be seen that this useful invention is of general interest, and not only as affects private houses, but for breweries, manufactories, and all places where large fires are required, and by its adoption the use of enormous chimneys might be dispensed with, as no smoke is generated. The expense with the gas now used for lighting would render a fire on this new principle about the same expense as if coals were employed, but, were what is termed non-carbonized gas employed, a great diminution of expense would be obtained.

Cheetham's System of Bleaching or Colouring Cotton Slivers.—A curious novelty has been lately patented and introduced into the cotton manufacture, by Mr. Cheetham of Chadderton, near Oldham, for the purpose of avoiding imperfections in the processes of bleaching and colouring yarns, as well as some of the expensive operations hitherto requisite in the routine of manufacture. In place either of bleaching the raw cotton, or bleaching, dyeing, or printing the yarn as at present, the inventor subjects his material to these processes in the sliver state, as it comes from the carding-engine, thereby avoiding waste, whilst the spongy and regular disposition of the fibres permits of their easy permeation by the chemical matters employed. In producing party-coloured threads, greater brilliancy of colour is secured, whilst the doubling operation is altogether dispensed with, as, by the combination of a number of slivers or "slubbings" of different colours, the party-coloured effect is produced at a single spinning operation. After leaving the drawing-frame, the slivers are passed through a slubbing-frame, which gives rather more than the ordinary twist, so that the processes newly inserted at this stage may not affect the continuity of the fibre. The slubbings are then reeled, and are bleached, dyed, or printed, as may be necessary. The superfluous or "false" twist is now taken out of them, by passing between the front rollers of a slubbing-frame, in which the flyers work the reverse way. The material is afterwards worked up in the ordinary manner. In producing party-coloured yarn, a number of slubbings of the required variety of colours are drawn and doubled to bring them into a single roving, suitable for the required party-coloured yarn. Thus, if a thread of a given count, composed of one-fifth green and four-fifths purple, with a draft of five, is wanted from prepared slubbings of purple, some of green will give the required tint. Instead of this specific routine which we have described, Mr. Cheetham proposes to produce a like result at any stage after the carding operation. The essential feature of his plan being the introduction of the bleaching or colouring processes, at any stage between the carding and spinning.

Boutigny's Diaphragm Steam Boiler.—M. Boutigny, whose curious researches as to the spheroidal condition of water in contact with excessively heated metal, attracted so much attention a year or two ago, and led to so many collateral results of importance, has presented to the notice of English engineers a new boiler, the theory of the arrangement of which is based upon the principle that "bodies evaporate only from their surfaces." The boiler which the inventor has constructed, has worked a two-horse engine for some time at Paris. It consists of a vertical cylinder 25 inches high by 12⅝ inches diameter, the base terminating hemispherically, whilst its upper end is closed by a curved lid, having the usual steam and water pipes attached to it. The interior contains a series of horizontal diaphragms of wrought-iron, pierced with fine holes, and having alternately convex and concave surfaces. These are suspended from three iron rods at given distances asunder, in such manner as not to be in contact with the heated exterior of the boiler. The feed-water falls on the upper diaphragm, which is convex, and tends to spread the fluid towards the periphery, whilst a large quantity falls through perforations in the form of minute globules. The second diaphragm beneath, being concave, brings back the water from its periphery, where it falls to the centre, and this action is repeated throughout, whatever number of diaphragms may be used, until, if any of it reaches the bottom of the cylinder, it mingles with a thin film of water in a high state of ebullition, the bottom being the hottest part of the boiler. In its transit over the diaphragms, the water is so finely divided, and passes over so large an extent of heating surface, that steam is raised with great rapidity, and with economy of fuel. The Parisian experiment shows the consumption of coal for the conversion of 789 lbs. of water into steam in 9 hours, under a steam pressure of 10 atmospheres, to be 182 lbs. It has been shown that at this temperature, the iron is in the best condition to bear severe strain. The idea of passing the water over the diaphragms to gain an extension of heating power, is peculiarly elegant.

Archer's System of Dividing Sheets of Postage Stamps.—The Exchequer and Post-office authorities have for some time had under consideration an ingenious plan, patented in this country by Mr. Henry Archer, an American, for facilitating the separation or detachment of each individual postage stamp from the large sheets in which they are printed. Mr. Archer's mode of effecting this object consists in forming a row of minute perforations round the margin of each stamp, so that, although sufficient holding material is left to retain the stamps in the sheet form, the user may separate each stamp with facility, by tearing through the lines of perforations. On submitting the invention to the government, Mr. Archer met with the usual vexatious delays attending the movements of those in power, and was finally referred by Sir Charles Wood to the Postmaster-General. Here it was tested with very favourable results, and a short time back the sum of £2,000 was offered for the machine, in full of all claims for its use, by the government. This compensation has been refused as quite inadequate, seeing that at the present rate of consumption, it had been calculated to produce £6,000 a-year, in the hands of a public company. Mr. Archer has also made an offer, in conjunction with Mr. Branston, the engraver to the late Commissioners of Excise, to engrave, print, gum, and perforate the stamps at a rate which will effect a saving to the country of £2,000 a-year. Thus the matter rests. It is to be regretted that so useful a scheme should not be put to use, as the improvement is really of some importance. The members of the House of Commons, to whom the perforated labels were supplied as a trial, last session, as well as the Post-office distributor of the district, have expressed opinions that the sheets so prepared would be preferably used, even at an advance in cost.

Teal's Thermometric Ventilator.—Mr. Teal, of Philadelphia, has lately invented an ingenious self-acting mercurial ventilator, which appears to possess all the accuracy and nicety of action necessary in apparatus of this nature, without any complexity of details. The valve he uses is a circular disc, like an ordinary damper or throttle-valve of a steam-engine. It is accurately balanced on a spindle, carried in delicate bearings, and has on one side an inverted siphon, with a bulb at one end, and open at the other. The lower portion of the siphon tube contains mercury, whilst the bulb is filled with atmospheric air. The action of this simple contrivance is, that any increase in the surrounding temperature expands the air in the bulb, driving the mercury down one leg of the siphon tube, and up the other—thus deranging the valve's balance—when the partial revolution which results opens the air passage. On the other hand, the lowering of the temperature diminishes the bulk of the air in the bulb, when the mercury reacts, rising in the tube, and, by its weight, turning over the valve to reduce the air passage.

Discharge of Water through Pipes under varying Head Pressures.—The actual variation in the rate of the fluid discharge through an opening, the area of which is constant, whilst the head pressure, or height of the column, varies, as tried at the Gorbals Gravitation Works, Glasgow, gives the following results:—

Head.	Discharge.	Head.	Discharge.
200	919	140	769
190	895	130	741
180	872	120	712
170	847	110	681
160	822	100	650
150	796		

The table ranges from 200 feet of a water-column, down to 100—the relative discharges at these two pressures being as 919 to 650. The actual pressure on the larger pipes of the works in question, ranges from 200 feet at night, to 170 during the day, when the town is drawing off its supplies. But the pressure indicator of the works shows that in the smaller pipes the pressure is really reduced to 100 feet every few minutes, the fluid accumulations and reductions causing a constant series of oscillations of pressure.

A Fact in British Ship-Building.—Whatever may be the real merits, or the contrary, of the late legal enactments bearing on the mercantile marine of Great Britain, it is a fact that there is just now in the Tyne, a new vessel belonging to a company at Hamburgh, for whom she was built in this country, at something like £3 a ton less than she could have been supplied for at Hamburgh. She is 484 tons, new measurement, and was built at Sunderland for emigration purposes, at £9 a ton, and cost her owners £1,500 less than the Hamburgh price for a similar vessel—the shipwrights on the Wear being paid 4s. a day.

A Plea for the Exhibition Building.—Amongst the many protests against the destruction of the Hyde Park Palace, we find an anonymous letter in the *Times*, in which are the following powerful remonstrances:—"In youth I loved to dream over Bacon's picture of his *New Atlantis*; it was to me a fairy tale. In maturer days, the *Novum Organum* and the *De Augmentis* were not less fondly loved. It was impossible to resist the natural impulse which leads one to gaze into the future, and trace the law of progress. 1. The Park may have a little Atlantis—not a place where emulous nations carry their rival productions, but a place for the advancement of man. I would have there every natural product classified and arranged—from the clays of China and of Devon, to the gold of Australia and of the Ural Mountains; not a higgledy-piggledy squabble of different national

products, but a broad union of gifts bestowed by our Maker on man. There is iron as good as that of Sweden or of Northamptonshire, if it were brought into notice, for the purpose of making steel. Other stones than those of Germany and France might serve for lithography, if specimens of them could be brought together. A committee would hardly be necessary to select stones for another House of Parliament; nor would the fronts of our colleges at Oxford be any more faced with stone which is inevitably doomed to rot with frost, and crumble away with the rain. No one can calculate the value of a due appreciation of natural products. America is opulent by the cultivation of one or two plants; Staffordshire was enriched by the discovery of a possible use for a few burnt flints; hundreds of sorts of wood exist uncared for in Africa and in the East, while our drawing-rooms seldom go beyond a little rose, satin, or tulip woods. Strength, lightness, and durability—say nothing of beauty—are not all combined in mere mahogany. On a little German sand depends the excellence of many of our best optical instruments; most probably quite as good might be found in England, but no one looks for it. Not a plant, root, earth, mineral, ought to escape. There is other fibre than that of flax; there is other downy product than that of cotton. 2. Still more would the place serve for a standing Polytechnic in works of art. Every description of valve, crank, spindle, joint, beveled wheel, screw, axle, lever, &c., ought there to stand in order. One hour's inspection is worth a month of hard work at books. Detail to obviate difficulties is invaluable to the inventor. Hours of ill-spent labour might thus be spared to the half-taught ingenious mechanic. Hundreds of machines were not represented in the Exhibition. A standing institution would obviate this. Why, too, should not every new hinge, lock, or even kitchen vessel, have a place where its merits might become known? Our comfort is dependent on these vulgar trifles. Thousands of pounds are gained by the production of a night-light or a superior lucifer match. Nothing really deserves contempt. I need hardly mention the immense importance of a standing collection of philosophical instruments. Not a new book, print, not a picture or statue, but might there address itself to the eyes and tastes of the public. Does not the world recollect how the crayons in Westminster Hall taught the Royal Academy men that there was other charcoal in existence? A poor artist has no chance of becoming known. Again, everybody pities the poor farmer. Suppose, instead of expensive agricultural meetings, he could go at any moment and see all which could be seen in the implement department. He would find it convenient whenever he came to London, especially if he could personally inspect the best collection of seeds in the world, to say nothing of all sorts of oilcake, broken rice, Indian corn, and feeding stuff. Much, too, might be done in the way of farm-yard models, suggestive of the neatest process of making muck and money; the former would soon be protected much more than it is. Not a pattern, not a model ought to escape the prying purveyors for the World's Museum. The eye can only by degrees be trained for design. Our humbler artists have but an indifferent chance. Our northern clime does not bestow the suggestive flora of the East; nor have our common people the geometrical training which produced the pattern of the Alhambra. Idolatry does not task our energies to produce the ideal or the marvellous. I wonder what the railway people and the steam navigation companies are doing. Make England a central spot, and you will not depreciate railway shares any how. One never goes to Sheffield or Manchester without seeing lots of foreigners staring about, and trying to see what they can. Men there have told me that no visitors are more welcome. They see and buy, and come to buy again, especially now that we do a little in return. There is not an inventor, not a man of genius, who would not reap benefit."

Railways in America.—The railway which extends from the Hudson river, through the southern counties of New York to Lake Erie, is a noble monument of perseverance and engineering skill. It is the longest known line, extending 469 miles, and having branches whose conjoined lengths equal 68 miles. The greatest natural obstacles have been overcome in its construction; for it passes almost entirely through a region of mountains. The bridges over the Delaware, Susquehanna, and other rivers, as well as the viaducts across the different valleys in its route, speak for the talent of its constructors. They are all of heavy masonry except one, a wooden bridge, 184 feet high, having one arch with a span of 275 feet. One of the viaducts is 110 feet high, and 1,200 feet long. The undertaking cost, altogether, 23,580,000 dlrs., the construction per mile being 43,333 dlrs. The line was first thought of in 1829. A company was organized, and surveys were made in 1832. A part of the route was granted in 1834, when operations were commenced. The State advanced 6,000,000 dlrs., afterwards making a grant of it to the company. It was finished and opened in May last, having been 19 years in constructing. In the United States, trains are generally run at a less speed than in England. The ordinary rate of passenger trains is 20 miles per hour, though on some routes it reaches 28 or 30 miles; and on the line between New York and Albany, it is 40 miles. Express trains, with the President's message, &c., run for considerable lengths at a speed of 45 miles per hour. The fares vary on the different lines. In New England, the average rate per mile for passengers is less than 2 c.; from New York to Boston, it is $2\frac{3}{4}$ c.; from New York to Philadelphia, $3\frac{3}{4}$ c.; from Philadelphia to Boston, $3\frac{1}{10}$ c. From New York to Cincinnati, 143 miles of the route, which is altogether 857 miles, are travelled by steamers. The fare, all the way, is 16 dlrs. 50 c.—average, a little less than 2 c. per mile. Lines between Baltimore and Cincinnati will soon be opened. The distance is 650 miles, and the fare will be 13 dlrs., or 2 c. per mile.—At the beginning of the present year, 10,814 miles of railway were in operation in the United States, and not less than 10,898 miles were then in course of construction, the greater portion of which, it is expected, will be completed in the course of the ensuing five years. The length of line brought into operation since January, 1848, amounts to 5,224 miles, of which 2,153 were finished during the year 1851. Never did there exist such great activity in the construction of railways in the United States as at the present time, and contracts for more than 1,000 miles, in addition to those already in course of construction, will be let in the course of the present year. The cost of the railroads in operation at the beginning of the present year is estimated at 348,000,000 dollars, being at the rate of 32,180 dollars per mile.

ENGLISH PATENTS.

Sealed from 20th March, to 15th April, 1852.

William Froggatt, Manchester, house and decorative painter,—"Certain improvement or improvements in the process of decorative painting, which improvement or improvements are applicable to rooms, halls, carriages, furniture, and other purposes to which decorative painting has or may be applied."—March 20th.

John M'Dowall, Walkinshaw Foundry, Johnstone, Renfrew, North Britain, engineer, —"Improvements in cutting wood and other substances, and in the machinery or apparatus employed therein, and in the application of power to the same parts of which improvements are applicable for the transmission of power generally."—20th.

William Westley Richards, Birmingham, gun-manufacturer,—"Certain improvements in fire-arms, and in the means used for discharging the same, also improvements in projectiles."—20th.

William Symington, Trafalgar-place, West Hackney-road, Middlesex, gentleman, Charles Finlayson, Manchester, engineer, and John Reid, of the same place, gentleman, —"Improvements in flues and in heating air, and in evaporating certain fluids by heated air."—22d.

John Drumgoole Brady, Cambridge-terrace, Middlesex, Esq.,—"Improvements in helmets, cartridge-boxes, and other military accoutrements."—22d.

Edward Morewood and George Rogers, Enfield, Middlesex, gentleman,—"Improvements in shaping, coating, and applying sheet metal to building purposes."—24th.

John Macintosh, Berner's-street, Middlesex, civil engineer,—"Improvements in ordnance and fire-arms, and in balls and shells."—24th.

Antoine Maurice Tardy de Montravel, Paris, France, gent.,—"Certain improvements in obtaining motive power, and the machinery employed therein."—24th.

Isaac Brookes, Birmingham, manufacturer, and William Lutwyche Jones, Birmingham, aforesaid, manufacturer,—"Certain improvements in stoves, and other apparatus for heating."—24th.

William Whitaker Collins, Buckingham-street, Adelphi, civil engineer,—"Certain improvements in the manufacture of steel."—24th.

William Cole, Birkenhead, Chester, architect, and Alfred Holt, Liverpool, Lancaster, civil engineer,—"An improved method of preventing and removing the deposit of sand, mud, or silt, in tidal rivers in certain cases, and also in harbours, docks, basins, guts, or other channels communicating with the sea through tidal rivers, or otherwise, the same being applicable in certain cases to other rivers or moving waters."—24th.

John White and Robert White, Cowes, in the Isle of Wight, ship-builders,—"Improvements in ship-building."—24th.

William Henry Hulseberg, Mile-end, Middlesex,—"Certain improvements in the treatment of wool, hair, feathers, fur, and other fibrous substances, and in machinery or apparatus for the same."—24th.

William Archer, Hampton-court, Middlesex, gent.,—"An improved mode, or modes, of preventing accidents on railways."—24th.

Thomas Bell, Don Alkali Works, South Shields,—"Improvements in the manufacture of sulphuric acid."—24th.

Richard Paris, Long-acre, Middlesex, modeller,—"Improvements in machinery or apparatus for cutting and shaping cork."—24th.

William Pidding, Strand, gentleman,—"Improvements in the construction of vehicles used on railways, or on ordinary roads."—24th.

Edward Hammond Bentall, Heybridge, Essex, iron-founder,—"Improvements in the construction of ploughs."—25th.

John Smith, Bilston, Stafford, brass-founder,—"Certain improvements in locomotive and other steam-engines."—25th.

Jean Jacques Bourcart, of the firm of Nicholas Schlumberger and Company, of Guebwiller, France,—"Improvements in preparing, combing, and spinning wool and other fibrous materials."—(Partly a communication.)—27th.

William Thompson, Salford, Lancaster, machine-maker, and John Hewitt, Salford, aforesaid, machine-maker,—"Improvements in machinery for spinning, doubling, and twisting cotton and other fibrous substances."—27th.

James Melville, Roebank Works, Lochwinnoch, Renfrew, North Britain, calico-printer, —"Improvements in weaving and printing shawls and other fabrics."—29th.

James Timmins Chance, Handsworth, Stafford, glass manufacturer,—"Improvements in the manufacture of glass."—(A communication.)—29th.

Charles Jack, Tottenham-court, New-road,—"Improvements in machinery for grinding pigments, colours, and other matters."—29th.

John Whitehead, Holbeck, York, machine manufacturer,—"Improvements in machinery for preparing, combing, and drawing wool, silk, and other fibrous substances."—29th.

John Flack Winslow, City of Troy, in the State of New York, in the United States of America, ironmaster,—"Improvements in machinery for blooming iron."—31st.

Moses Poole, Patent Bill-office, London, gentleman,—"Improvements in fire-arms."—(A communication.)—31st.

William Earnshaw Cooper, Mottram, Chester, tallow-chandler,—"Certain improvements in the manufacture of candles and candle-wicks, and in the machinery or apparatus employed therein."—April 2d.

Joseph Pinlott Oates, Lichfield, Stafford, surgeon,—"Certain improvements in machinery for manufacturing bricks, tiles, quarries, drain-pipes, and such other articles as are, or may be, made of clay or other plastic substances."—6th.

Samuel Fox, Stocks-bridge Works, Deepcar, near Sheffield,—"Improvements in umbrellas and parasols."—6th.

William Watson Pattinson, Felling-new-House, Gateshead, manufacturing chemist,—"Improvements in the manufacture of chlorine."—6th.

Moses Poole, Patent Bill-office, London, gentleman,—"Improvements in covering wires for telegraphic purposes."—(A communication.)—6th.

John Walter De Longueville Giffard, Serle-street, Lincoln's-inn, barrister-at-law,—"Improvements in fire-arms and projectiles."—6th.

Charles William Siemens, Birmingham, engineer,—"An improved fluid meter."—(A communication.)—15th.

François Joseph Beltzung, Paris, in the Republic of France, engineer,—"Improvements in the manufacture of bottles and jars of glass, clay, gutta-percha, or other plastic material, and caps and stoppers for the same, and in machinery for pressing and moulding the said materials."—15th.

Edwin Pettit, Kingsland, Middlesex, civil engineer, and James Forsyth, Caldbeck, Cumberland, spinner,—"Improvements in machinery for twisting, drawing, doubling, and spinning of cotton, wool, silk, flax, and other fibrous substances."—15th.

Alfred Vincent Newton, Chancery-lane, mechanical draughtsman,—"Improvements for preventing the incrustation of steam-boilers, which invention is also applicable to the preservation of metals and wood."—(A communication.)—15th.

Charles Seely, Lincoln,—"Improvements in the manufacture of flour."—15th.

Thomas Ellwood Horton, Priors-Lee-Hall, Salop, ironmaster, and Elisha Wylde, Birmingham, engineer,—"Improvements in apparatus for heating and evaporating."—15th.

Simon Davy, Rouen, France, merchant, and Adolphe Ludovic Chann, Paris, France, merchant,—"Improvements in explosive compounds and fusees, and also in methods of firing the same."—15th.

SCOTCH PATENTS.

Sealed from 22d February, to 22d March, 1852.

William Hamer, Manchester, Lancashire,—"Certain improvements in looms for weaving."—February 23d.

Peter Armand Le Comte de Fontainemoreau, 4 South-street, Finsbury, London, patent agent,—"Certain improvements in gas-burners."—26th.

Charles John Mare, Blackwall,—"Improvements in constructing iron ships or vessels and steam-boats."—March 1st.

Henry Glynn, Bruton-street, Berkeley-square, and Rudolph Appel, Gerrard-street, Soho, annastatic printer,—"Improvements in the manufacture or treatment of paper or fabrics, to prevent copies or impressions being taken of any writing or printing thereon."—1st.

William Edward Newton, Office for Patents, 66 Chancery-lane, London, civil engineer, —"Improvements in the heddles or harness of looms for weaving, and in the machinery for producing the same."—2d.

Henry Bessemer, Baxter House, Old-street, St. Pancras-road, Middlesex,—"Improvements in expressing saccharine fluids, and in the manufacture, refining, and treating of sugar."—3d.

Frederick Crace Calvert, Manchester, Lancaster, professor of chemistry,—"Improvements in manufacturing iron, and in manufacturing and purifying coke."—4th.

John Henry Johnson, of the Office for Patents, 47 Lincoln's-inn-fields, Middlesex; 166 Buchanan Street, Glasgow; and 20 St. Andrew Square, Edinburgh, gentleman,—"Improvements in weaving carpets and other fabrics, and in the machinery and apparatus employed therein."—4th.

William Sinclair, Manchester, Lancaster, engineer,—"Certain improvements in locks."—8th.

John Blair, Irvine, Ayr, North Britain, gentleman,—"Certain improvements in beds and couches, and other articles of furniture."—9th.

Perry G. Gardiner, New York, America, civil engineer and machinist,—"Improvements in the manufacture of malleable metal into pipes, hollow shafts, railway wheels, or other analogous forms, which are capable of being dressed, turned down, or polished in a lathe."—10th.

Alfred Vincent Newton, Office for Patents, 66 Chancery-lane, Middlesex, mechanical draughtsman,—"Improvements in machinery for combing wool and other fibrous substances."—15th.

Alexander Cuninghame, Glasgow, Lanark, North Britain, iron-master,—"Improvements in the treatment and application of slag, or the refuse matter of blast furnaces."—15th.

William Charles Scott, Camberwell, Surrey, gentleman,—"Improvements in the construction of omnibuses, and other public and private carriages."—15th.

William Stirling Lacon, Great Yarmouth, Norfolk, gentleman,—"Improvements in the means of suspending ships' boats, and lowering the same into the water."—16th.

John Mercer, Oakenshaw, Clayton-le-Moors, chemist, and John Greenwood, Irwell Springs, Bacup, turkey-red dyer, both in Lancaster,—"Certain improvements in preparing cotton and other fabrics for dyeing and printing."—17th.

Charles Middleton Kernot, West Cowes, Isle of Wight, M.D., and William Hirst, Manchester, Lancaster, manufacturer,—"Certain improvements in the manufacture of woollen cloth, and cloth made from wool and other materials, and in machinery or apparatus for manufacturing the same."—17th.

John Ramsbottom, New Mills, Derby, engraver,—"Certain improvements in machinery or apparatus for measuring or registering the flow of water, and other liquids or vapours, which machinery or apparatus is also applicable to registering the speed of, and distance run by vessels in motion, and also in obtaining motive power, and other similar purposes."

John Wallace Duncan, Grove-end-road, St. John's Wood, Middlesex, gentleman,— "Improvements in engines, in applying the power of steam, or other fluids, for impelling purposes, and in the manufacture of appliances for transmitting motion."—22d.

Edward Mosely Perkins, Mark-lane, London, Esq.,—"Improvements in the manufacture of cast-metal pipes, retorts, or other hollow castings."—22d.

Charles Barlow, 89 Chancery-lane, London, Esq.,—"Improvements in rotary engines."—22d.

William Pidding, Strand, Middlesex, gentleman,—"Improvements in mining operations, and in machinery or apparatus connected therewith."—22d.

James Joseph Brunet, Canal Iron Works, Poplar, Middlesex, engineer,—"Certain improved combinations of materials in ship-building."—22d.

Emmanuel Charles Theodore Croutelle, manufacturer, Rheims, France,—"Certain improvements in machinery or apparatus for preparing woollen threads and other filamentous substances for weaving."—22d.

William Symington, Trafalgar-place, West Hackney, Middlesex, gentleman, and Charles Finlayson, Manchester, and John Reid, of the same place, gentleman,—"Improvements in flues and in heating air, and in evaporating certain liquids by heated air."—22d.

IRISH PATENTS.

Sealed from 22d February, to 22d March, 1852.

George Gwynne, Hyde-park-square, Middlesex, Esq., and George Ferguson Wilson, managing director of Price's Patent Candle Company, Belmont, Vauxhall,—"Improvements in treating fatty and oily matters, and in the manufacture of lamps, candles, night-lights, and soap."—February 24th.

Hermane Turck, Broad-street Buildings, London, merchant,—"Improvements in the manufacture of resin oil."—(Communication.)—24th.

William Jean Jules Varillat, Rouen, France,—"Improvements in the extraction and preparation of colouring, tanning, and saccharine matters, from various vegetable substances, and in the apparatus to be employed therein."—March 15.

Charles Middleton Kernot, West Cowes, Isle of Wight, M.D., and William Hurst, Manchester,—"Certain improvements in the manufacture of woollen cloth, and cloth made from wool and other materials, and in machinery and apparatus for manufacturing the same."—15th.

Sir John Scott Lillie, Pall-mall, Middlesex, Companion of the Most Honourable Military Order of the Bath,—"Certain improvements in the construction and covering of roads, floors, walls, doors, and other surfaces."—16th.

John Wormald, Manchester, Lancashire, maker-up and packer,—"Certain improvements in machinery or apparatus for spinning and doubling cotton, wool, silk, flax, or other fibrous substances."—16th.

Henry Glynn, Bruton-street, Berkeley-square, gentleman, and Rudolph Appel, Gerrard-street, Soho, annastatic printer,—"Improvements in the manufacture or treatment of paper or fabrics, to prevent copies or impressions being taken of any writing or printing thereon."—16th.

DESIGNS FOR ARTICLES OF UTILITY.

Registered from 18th March, to 14th April, 1852.

Mar. 18th,	3184.	T. Lepeinteur, College-yard, Worcester,—"Glove-binding."
19th,	3185.	J. Schloss, Friday-street,—"Briquet."
—	3186.	H. and S. Schloss, Paris,—"Vulcan porte-cigar."
Mar. 20th,	3187.	J. Kimberley, Birmingham,—"Tenoning or tenanting chisel."
—	3188.	F. Stammers, Strand,—"Facilis fastening for trousers and garments."
—	3189.	S. Ellithorn and John Shaw, Preston,—"Tuning-key."
23d,	3190.	C. and J. Clark, Street, Somerset,—"Elastic gusset for boots."
—	3191.	J. Roberts and W. Winter, Cotton-hill, Nottingham,—"Glove-fastening."
—	3192.	George Mullin, Glen-house, Guilford,—"Ring-stone for grinding grain."
24th,	3193.	J. W. and D. Allen, West Strand,—"Elongating portable iron chair."
—	3194.	G. Macintosh, Glasgow,—"Self-acting balance-seat for carriages."
25th,	3195.	Thomas Whitehead, Leeds, and Samuel Smith, Keighley,—"Dead spindle."
26th,	3196.	Simcox, Pemberton, and Sons, Birmingham,—"Rack-pulley."
27th,	3197.	Arthur James, Redditch,—"Needle-case."
—	3198.	James Coombe & Co., Belfast,—"Flax-holder."
29th,	3199.	E. de Maignol Mataplane, South-street, Finsbury,—"Circular tilting platform."
—	3200.	Hall and Wilson, King-street, Manchester,—"Trimmer, or beam for supporting hearthstones."
—	3201.	W. B. Johnson, Manchester,—"Steam-pressure guage and signal-whistle.
—	3202.	Michel Roch, South-street, Finsbury,—"Letter envelope."
Apr. 2d,	3203.	W. S. Adams, Haymarket,—"Sponging-pan or bath."
3d,	3204.	Fenwick de Porquet, of the firm of Mary Wedlake & Co., Tavistock-street, Covent-garden, and Fenchurch-street,—"The utilitarian, or hay and straw-cutting machine with corn-crushing machine combined."
—	3205.	John Dangerfield, Hill-top, West Bromwich,—"Safety-valve and water-indicator for steam-boilers."
7th,	3206.	F. Somner, Kelso, North Britain,—"Stack or rick ventilator."
—	3207.	W. Hughes, Manchester,—"Typograph for the blind."
8th,	3208.	E. A. Baker, Whitechapel-road,—"Improved gun-lock."
10th,	3209.	J. Collins, Birmingham,—"Safety lever bolt."
—	3210.	E. Poulson, Sunderland,—"Reverse levers for shipping."
—	3211.	J. Atkin, Huntingdon,—"Crutch elastic."
—	3212.	W. Weild, Manchester,—"Pipe-cutter."
—	3213.	J. Howard, Berner's-street,—"Circular extending and oblong dining-table."
11th,	3214.	J. Fletcher & Co., Glasgow,—"Duplex reversible and expanding cap."
—	3215.	J. Brooks, Birmingham,—"Clog."
—	3216.	O. L. Detouche and E. Brisbart, Castle-street, Holborn,—"Electro-magnetic clock."

DESIGNS FOR ARTICLES OF UTILITY.

Provisionally Registered from 18th March, to 17th April, 1852.

Mar. 19th,	374.	Henry Maling, Esq., Home-office,—"Elevation sight for ball-shooting."
—	375.	Edward Williams, Manchester,—"Self-acting spring tap.
—	376.	Kerby and Son, Oxford-street,—"Envelopes for books and other articles."
20th,	377.	Edward Warren, Bloomfield-terrace, Hyde-park,—"Pipe cane."
—	378.	Edward Warren, Bloomfield-terrace, Hyde-park,—"Cigar cane."
22d,	379.	G. P. Cooper, Suffolk-street, Pall-mall, East,—"Elliptic shirt collar."
23d,	380.	Louis Schmitthenner, Agar-st., Strand,—"Breech of a rifle barrel."
—	381.	Louis Schmitthenner, Agar-st., Strand,—"Rifle bullet or projectile."
—	382.	Louis Schmitthenner, Agar-st., Strand,—"Form of rifle groove."
—	283.	Louis Schmitthenner, Agar-st., Strand,—"Form of rifle groove."
25th,	384.	Chubb and Son, St. Paul's-churchyard,—"Segmental guard for lock."
—	385.	John Brinsted, Porchester,—"Union fire-irons."
27th,	386.	John Dicker, Clarence-terrace, Islington,—"Traductor."
—	387.	J. J. Catterson, Cloudesley-terrace, Islington,—"Compound carriage spring."
29th,	388.	J. T. Campion, Exeter, surgeon,—"Mould for casting hollow or Minie rifle bullets."
—	389.	William Redgrave, Grafton-street, Fitzroy-square,—"Cricket-guard."
April 3d,	390.	W. Wellby, Bermondsey,—"Life buoy."
8th,	391.	W. and C. Clay, Broad-street, Golden-square,—"Projectile."
—	392.	G. Hull, Peckham,—"Lamp glass or shade."
10th,	393.	J. C. Gunn, Edinburgh,—"Collar for connecting pipes."
—	394.	E. Poulson, sen., Sunderland,—"Pendulum lever pump break."
14th,	395.	G. Fletcher & Co., Wolverhampton,—"Portable bedstead."
—	396.	P. A. Fontainemoreau, South-street, Finsbury,—"Self-indicating altimeter."
—	397.	J. Gedge, Wellington-street, Strand,—"Self-opening umbrella or parasol."

TO READERS AND CORRESPONDENTS.

A. J., Swindon.—The presence of water does not interfere with the matter at all. After the air is removed, the space not taken up by the fluid must obviously be a vacuum.

J. O. H., Cornwall.—See "Wickstead on the Cornish Engine." Mr. Weale, of Holborn, will inform him as to price of both works.

H. D.—We regret that this must be delayed to next month.

J. B., Greenock.—We have engraved his sketch, but it cannot appear until next month.

A. H. R.—We will inquire into the two points more closely. We are obliged for his suggestions.

J. W., Leeds.—His sketch has been received; but we regret that the particulars are so meagre. What we wanted was the actual copy, as registered.

W. A., Farnham, will see that we have attended to him.

D. V.—We are afraid that, although "Truth is offered to all," our correspondent has not exactly got hold of it. His scheme is one of the many apparently plausible ones of the past half century—too ingenious to laugh at, yet too absurd to prevent a smile.

Received.—"The Machinery of the 19th Century," Parts 2 and 3.—"Jordantype, otherwise called Electrotype," by H. Dircks.

G. R. B.—We are in possession of his printed particulars.

A Constant Reader.—We presume he refers to the views of Mr. Pearson, the City Solicitor. The subject is of the highest importance, and we certainly think the project a very feasible one.

Plate 99.

POWE

MESSRS. DICKINSO

PA

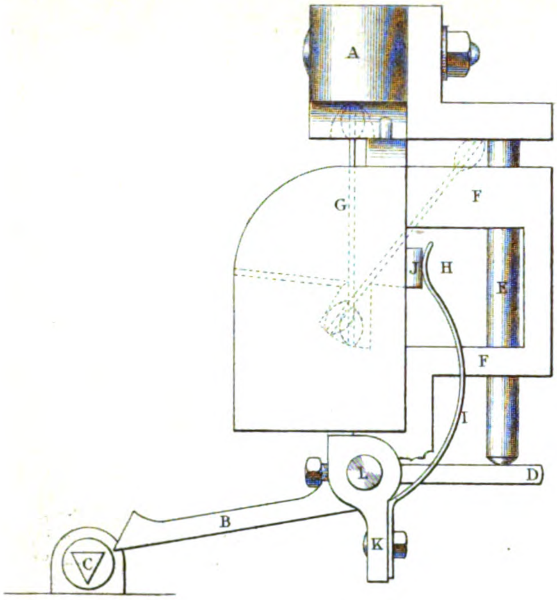
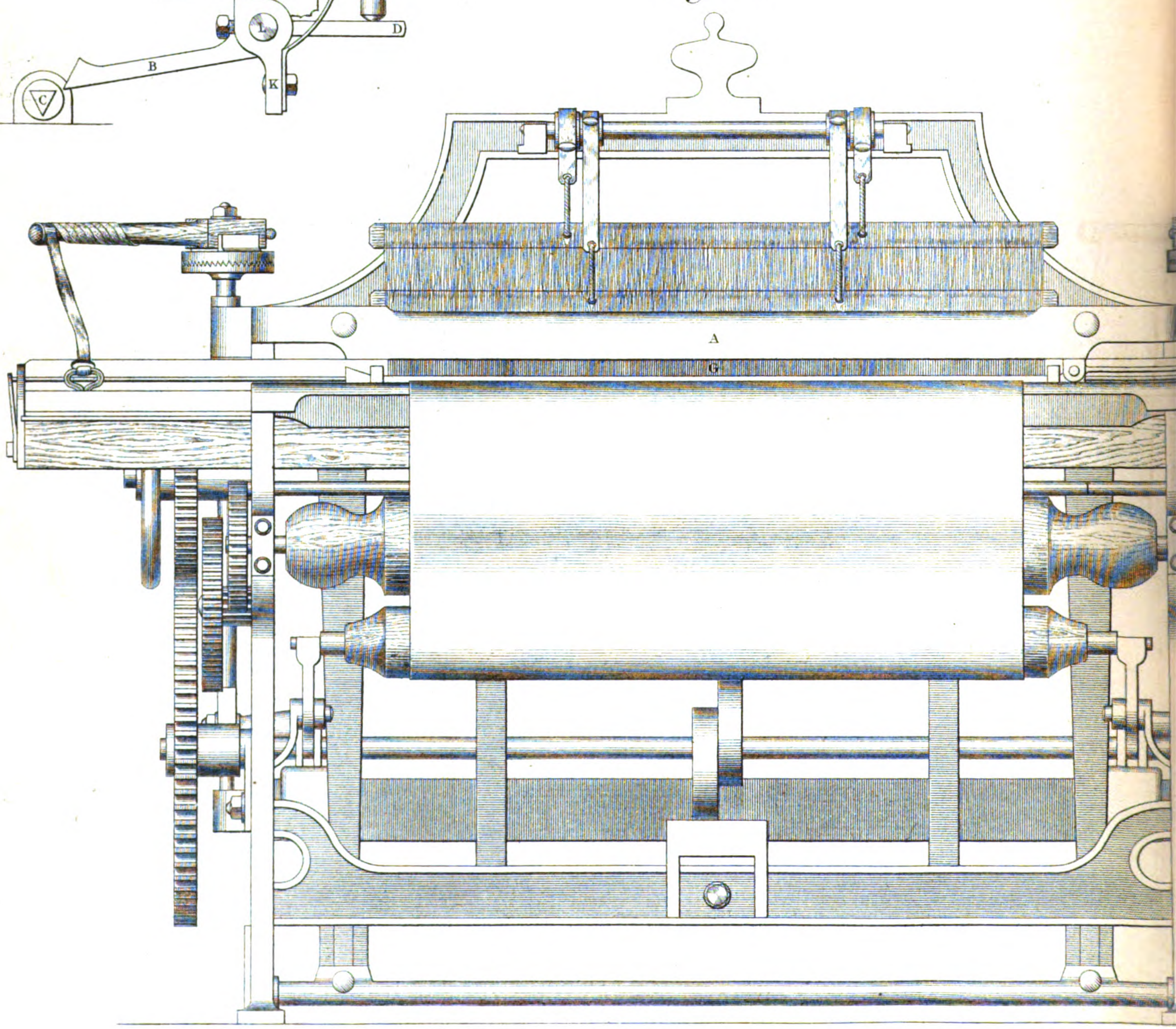


Fig. 3.

Fig. 1.



W. Johnson, Patent Offices,
London Glasgow & Edinburgh.

R-LOOM.

& *WILLAN , BLACKBURN,*

NTEES.

Fig. 4.

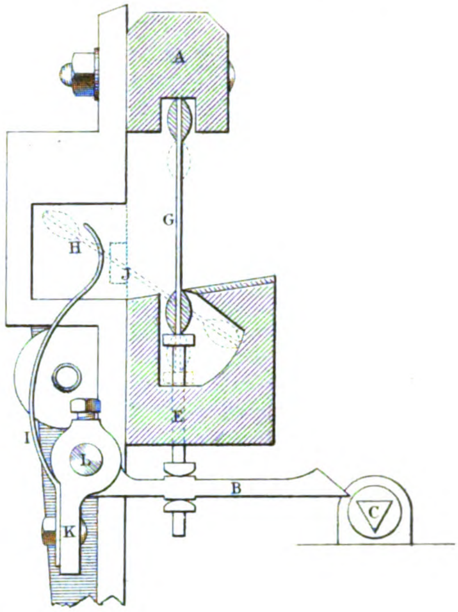
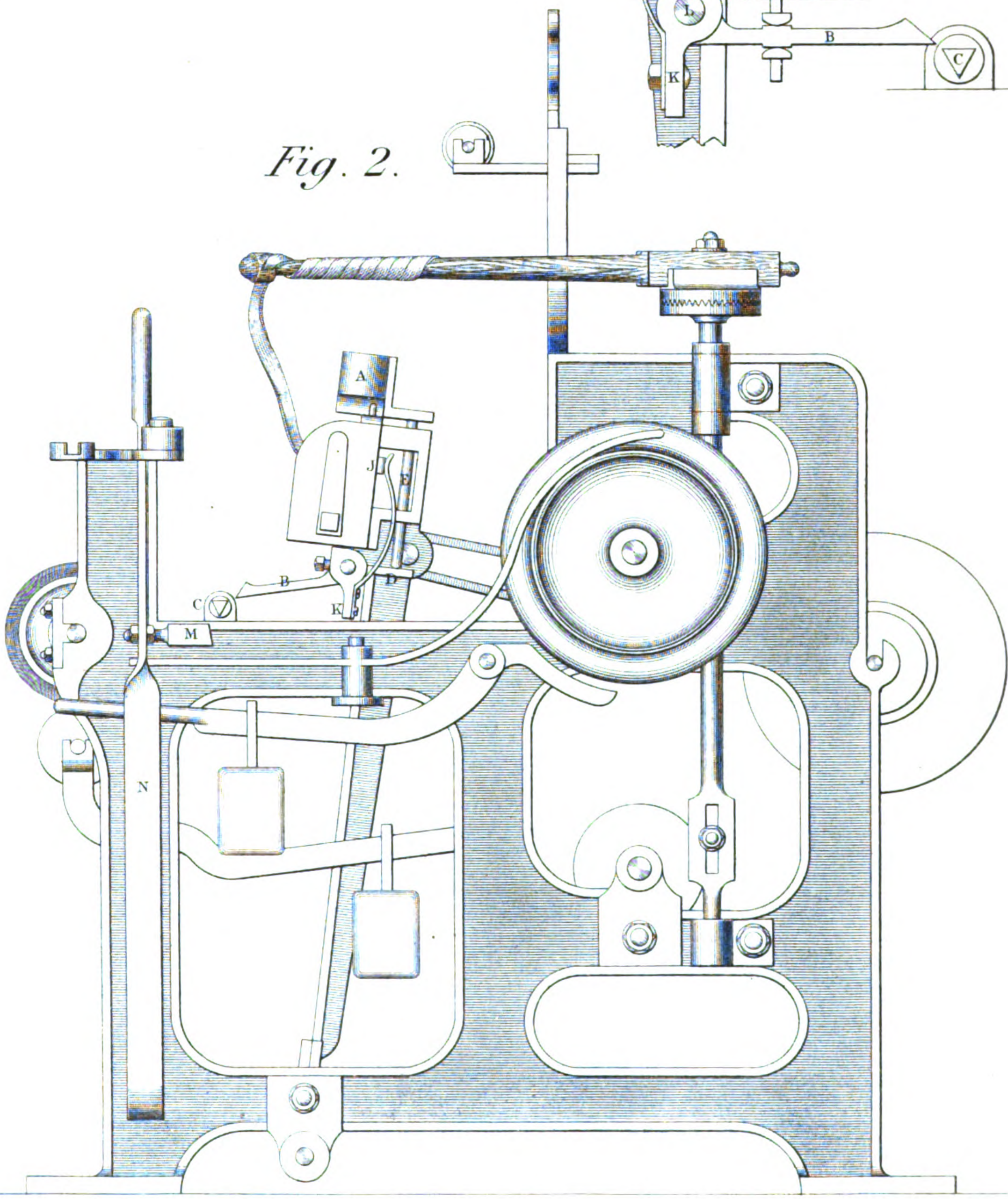
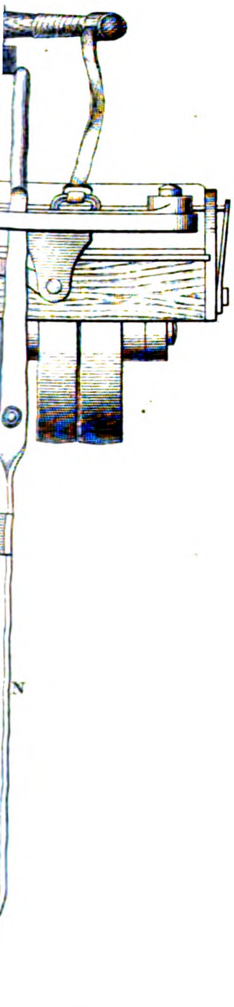


Fig. 2.





G. Gladwin sc.

DICKINSON AND WILLAN'S POWER-LOOM.

(*Illustrated by Plate* 99.)

It has long been a question of much anxious inquiry amongst the makers of textile machinery, as to how far it is possible to reduce the concussions and consequent breakage of the mechanical details of the power-loom—a machine which, perhaps, of all others, in the complex array of the manufacturer's mechanical assistants, is the most subject to injurious wear and tear. We have, first, the sudden striking of the picking motion, for the present rapid transfer of the shuttle from one side of the fabric to the other; and with this may be coupled some pretty severe straining arising from the quick reciprocatory action of the cranks and slay. Then there is the constant risk of injury to the warp threads by the interception of the shuttle in the warp shed, while on its way from one box to the other; or the actual throwing out of the shuttle, either of which casualties causes a severe "bang," from the finger of the stop-rod coming in contact with the fast "frog" on the framing, placed there to prevent the fracture of the warp threads from the slay or lathe beating up against the shuttle.

Amongst the more memorable attempts at the reduction of these very serious working strains, is to be named the "loose reed" of Mr. Bullough, as well as the fast reed and "brake" of Mr. Sellers; and lastly, the "spring-brake," or rather lever, of Mr. Dickinson, patented in 1849. Of these, on the one hand, Mr. Bullough's loose reed is inapplicable for weaving strong cloths, on account of its giving way when striking up the weft, and the increased wear and tear of the many additional working parts; whilst, on the other, all weaving experiences show, that all fast-reed looms are quite unsuited for any scheme of softening concussion, even with the assistance of Mr. Seller's brake, as well as that they cannot maintain the high rate at which the loose reed is now worked. Both plans have found active supporters, and have been extensively adopted; but the removal of the defects on each side has only now been sought, in the amalgamation of the acknowledged advantages of both the fast and loose reeds. This is successfully accomplished in the recently patented loom of Messrs. Dickinson and Willan of Blackburn. Our Plate 99 presents two combined and two detailed views of this loom.

Fig. 1 is a front elevation of the loom, complete for work; and fig. 2 is a corresponding side view, looking on the driving-pulley and stop-rod side. Fig. 3 is an end elevation of the slay and loose reed, and stop apparatus; and fig. 4 is a transverse section of the same parts slightly modified. It embodies, in the first place, a modification of the stop motion, by which the common stop-rod and frog are dispensed with—doing away with the concussion arising from their coming in contact on stopping. Secondly, an arrangement of the reed, whereby it may be said to be both fast and loose, for it is quite firm whilst the slay is actually beating up, and yet loose if the shuttle happens to be caught in the shed; and is capable of weaving any strength of fabric. Lastly, it involves a mode of easing the pressure of the shuttle against the swell in the shuttle-box. Whenever the shuttle is caught in the shed in the beat-up, its absence from the shuttle-box allows a spring, which presses against the swell, to fall a little inwards to the shuttle-box, and the other end of the spring being attached to a lever, the latter is drawn slightly outwards. This action causes another lever or finger, on the same rod, to fall a little, so as to pass under an angular stud, fast to the loom frame, instead of the common frog. On another lever, which is fixed on the same rod as the preceding one, there rests a vertical bar or rod, sliding in two brackets cast on the slay sword, to the top of which the slay cap is attached. Then the spring, by drawing one lever a little forward, causes the other to pass under an angular bar, and, by lifting the third lever, raises the vertical bar, and consequently the slay cap. This liberates the top of the reed, and allows it to fall back on the warp, by which action the shuttle is set free. The same results are also obtained by allowing the reed to be lowered by the action of the levers, in bringing down the vertical bar on which the reed rests, and freeing the top of the reed from the slay cap—the reed thus falling back on the warp, whilst the slay cap is stationary.

In our illustrative views, A is the slay cap, and B a lever acting against the angle-bar, C. A lever, D, lifts the vertical rod, E, sliding in the brackets, F, and this rod, being attached to the slay cap, lifts and liberates the top of the reed, G, allowing it to fall back on the warp, as indicated by the angular dotted lines, H. A blade-spring, I, presses against the back of the swell, J, in the shuttle-box, being attached at its lower end to the lever, K. When the shuttle is absent, the traverse of the upper end of the spring causes the lever, K, to move a little outwards, so that the free end of the lever, B, falls, and passes beneath the bar, C. The three levers, B, D, and K, being all attached to the rod, L, move simultaneously under the spring action. When the lever, B, is lowered, the horizontal lever, D, is raised, lifting with it the sliding-rod, E, and with it the slay cap, so as to liberate the reed.

When the lever, B, is in its lowest position, and has nearly arrived at the extremity of its forward traverse, it touches the adjusting piece, M, and, pressing still further, pushes the handle or stop-rod, N, out of its place, shifting the strap from the fast to the loose driving-pulley, and stopping the loom.

The enlarged detail, fig. 4, illustrates the mode of freeing the reed whilst the slay cap is stationary. The action of the principal movements is the same here as in the former arrangement, but the reed is set at liberty by the vertical rod, E, being brought down when the lever, B, is lowered, thus disengaging the top of the reed from its position in the slay cap. and allowing it to fall back on the warp.

About 3,000 of these looms, made at Mr. Dickinson's machine works in Blackburn, are now at work, weaving all kinds of goods, from the coarse and heavy domestic cloth to the finest muslin.

OUTLINES OF GEOLOGY.

II.

IGNEOUS ROCKS.

Igneous rocks, that is, rocks which have been more or less affected by heat derived from the interior of the globe, do not fall into a single division of the chronological series, but are of every age, some of them having, perhaps, been the first which appeared above the surface of the ocean, and others being products of volcanoes now in activity. No hypothesis as to the generation of internal heat has been generally adopted. The doctrine which, probably, has most authority on its side, is that which supposes the earth to have originated in a state of fusion, and to be now in process of cooling, a volcanic eruption being considered a reaction of the heated interior mass against the contracting exterior crust. Sir C. Lyell, however, doubts the sufficiency of the evidence adduced in support of this view. The inquiry is one of those in which the geologist requires the aid of the chemist. As yet, chemistry has given less assistance to geology than might, perhaps, have been expected. We are not aware that any chemical theory to account for volcanic phenomena has been suggested since that of Sir Humphry Davy, and little appears to have yet been done towards determining how far the existing knowledge of chemistry would go towards explaining the phenomena; yet the interesting results of the experiments of Sir James Hall, Mr. Gregory Watt, and Mr. W. O. Harcourt, would seem to offer great encouragement to the prosecution of similar experiments.

We shall consider igneous rocks under three heads—plutonic, metamorphic, and volcanic.

Plutonic rocks, of which granite is the type, are distinguishable from volcanic rocks by well-marked characters, being more crystalline and of closer texture, entirely free from those pores and cavities found in lavas, and being unaccompanied by the beds of loose material and conglomerates which occur with the latter. Like volcanic rocks, they penetrate not only sedimentary rocks, but also older igneous rocks, in veins and dykes. If we suppose that plutonic rocks, when in a state of fusion, were exposed to great pressure at low depths, and then were allowed to cool slowly, they would, when solidified, possess a more crystalline, as well as a closer texture, than rocks solidified under a less degree of pressure below the surface, or in contact with the atmosphere. It is

now generally held that granite is of all ages; and Lyell proposes to arrange plutonic rocks as primary, secondary, and tertiary, according to their contemporaneity with primary, secondary, or tertiary fossiliferous strata. To do so is, he admits, a difficult task, owing to the absence of organic remains among these rocks. Whatever may have been their original condition, heat has completely obliterated all traces of it, and therefore their age can only be ascertained by examining them at their junction with fossiliferous strata. Where the latter strata are unaltered at the surface of junction, we must suppose them to be more recent than the former, and conversely. Hence it would appear that plutonic rocks were produced before some of the older of the fossiliferous strata, though none, we believe, have yet been discovered older than the oldest known strata containing organic remains. The most recent granite yet discovered appears to be that observed by Mr. Darwin in the Andean chain, between Valparaiso and Mendoza, and which is supposed to belong to the tertiary epoch of stratified rocks.

Plutonic rocks have by no means always the same external appearance. The varieties of granite are numerous; and there are other members of the class which have received different names, such as syenite, school-rock, eurite, and pegmatite. The minerals of which plutonic rocks are composed, are always either felspar, quartz, mica, hornblende, or talc. Granite is commonly composed of the three first. These minerals may occur both of different colours and different size, whence arise different names. The best known varieties of plutonic rock are porphyritic, graphic, syenitic, and talcose granites. In order to be acquainted with these varieties, the student must have recourse to the examination of specimens.

It was formerly supposed that the plutonic rocks were the original crust of the earth, and had furnished the materials of the fossiliferous strata, which were supposed to be more recent. A new view has been suggested by Sir C. Lyell, that, on the contrary, the plutonic rocks may have been formed by the fusion of the sedimentary. The evidence in favour of this idea is afforded by metamorphic rocks, the principal varieties of which in Great Britain we shall now describe.

Metamorphic Rocks.—The principal beds in Great Britain are composed of the same ingredients as granite; namely, quartz, felspar, and mica. They occur of three kinds—gneiss, mica-schist, and clay-slate. With these are occasionally interspersed beds of hornblende-slate, chlorite-slate, quartz, and granular limestone.

Gneiss is composed of quartz, felspar, and mica, not in disseminated crystals, but arranged in alternate layers, with a slaty structure. Sometimes it consists almost entirely of felspar. Granite is usually interspersed amongst gneiss, and mica-schist is often found alternating with it. Occasionally, the ingredients of gneiss are so mixed with each other as to cause it to lose its slaty structure, and it then becomes granitic in appearance.

Mica-schist consists of mica, crystallized in plates, and quartz. The quartz is frequently in very small quantities. On the other hand, beds of almost pure quartz are not unfrequently interspersed with it, and also beds of chlorite and hornblende-slate.

Clay-slate.—The mineral constituents of this rock, which is much used for roofing houses, are not very well ascertained. Some mineralogists have classed it as a simple mineral. It bears considerable resemblance to felspar which has undergone some degree of chemical change. It is commonly of a blue colour, but it also occurs grey, red, and yellow. Beds of granular limestone, of chlorite-slate, and of quartz, are found with it. This bed connects the metamorphic and the simply sedimentary strata with some of the earliest beds, to which it bears so close a resemblance as to be almost undistinguishable from them.

The evidence that metamorphic rocks have been formed from fossiliferous strata, is derived from observing the effect produced in strata, undoubtedly of the latter kind, by the intrusion of plutonic rock. Thus, in Christiania, in Norway, certain fossiliferous strata have been so altered by the intrusion of granite, as to resemble hornblende-schist in one part, and granite in another. An interesting case of similar changes occurs in the neighbourhood of Carrara. Here the celebrated statuary marble, formerly supposed to be primitive, has been shown to be an altered limestone of the oolitic period. This was proved by tracing it to a locality where plutonic rock had not entered. There three kinds of rock were distinguishable, namely—1st, limestone, with nodules of flint; 2d, shale; 3d, sandstone. When these had been penetrated by plutonic rocks, they were converted into—1st, a white granular marble, with siliceous matter disseminated through it in the form of prisms of quartz; 2d, talc-schists, jasper, and hornstone; 3d, quartzite and gneiss. Similar changes, on a greater scale, are supposed to have taken place in the Alps. In the eastern part of this chain of mountains appear primary fossiliferous strata, the older secondary formations, and, finally, oolitic and cretaceous rocks; but in the "Central Alps," says Sir C. Lyell in his 'Elements of Geology,' "the primary fossiliferous and older secondary formations disappear, and the cretaceous, oolitic, and liassic strata graduate insensibly into metamorphic rocks, consisting of granular limestone, talc-schist, talcose-gneiss, micaceous-schist, and other varieties." The inference is, "that the disappearance both of the older, secondary, and primary fossiliferous rocks, may be owing to their having been all converted into crystalline schist."

Adopting this theory, metamorphic rocks would also admit of an arrangement into primary, secondary, and tertiary. Two questions, in fact, arise respecting this class ot rocks—When were they deposited? and when were they altered? The convenient name *hypogene*, or *produced below*, has been given to the plutonic and metamorphic rocks, to distinguish them from subaerial igneous rocks.

Geographical distribution of Hypogene Rocks.—According to Professor Phillips,* it may be affirmed, "that below all the series of strata existing in any country, masses of crystallized but unstratified rocks exist, so as to form a general floor, most irregular in surface, and of unknown thickness, on which the strata rest. These rocks are generally of the nature of granite; that is to say, largely crystallized aggregates of felspar with variable admixtures of mica and quartz, or more rarely quartz and hornblende, or quartz and hypersthene." If we now turn to Mr. Johnston's 'Physical Atlas,' we find that the first class of hypogene rocks occupies a very large part—about one-third—of the *superficies* of dry land on the globe.

In Europe, these rocks are less abundant than in the other parts of the world. In the British isles, it is in the Highlands and Western isles of Scotland, and in the mountains in the north-west and south-east of Ireland, that they chiefly occur. Metamorphic rocks occur in Cumberland, and in small patches in Wales, and granite protrudes so as to occupy considerable areas in Cornwall. Out of England, hypogene rocks occupy limited areas in France, Germany, the Peninsula, and Turkey. In the peninsula of Norway and Sweden, and in the neighbouring countries of Lapland and Finland, they are extremely abundant, that peninsula being composed chiefly of gneiss alternating with granite.

Of Asia, perhaps one-third consists of hypogene rocks, which occupy large areas in China and the central parts of the Asiatic continent.

Of Africa, more than half (the southern half) is composed of the same.

Of South America, according to M. Boué, nearly half, and of North America probably two-thirds, consist of the same, and about half of Australia.

We are accustomed to associate hypogene rocks with mountain elevations. We see, however, from the above statement, that they abound over vast tracts of comparatively low ground in Africa, North America, and Australia.

As the theory of the formation of plutonic rocks requires that they should have been formed under great pressure, we are astonished at the enormous superincumbent masses that must have been removed from above them, in order that they should appear at the surface. On the other hand, the material out of which subsequent fossiliferous strata have been formed is more easily accounted for. In this view, the metamorphic rocks, which now occur at the surface, would be relics of an ancient order of fossiliferous strata, which have probably been reconstructed beneath the ocean into quite a new order—a view which is illustrated in Lyell's remark, "that the earth's surface has been remodelled again and again;" and the question may perhaps arise, whether some of our present fossiliferous strata may not contain relics of some more ancient series mingled with their other contents?

Volcanic Rocks may also be arranged chronologically: they begin at an early period. In Pembrokeshire, for instance, masses of trap-rock and breccia alternate with rocks of the Upper Cambrian system. Some of the volcanic rocks have a greater resemblance to the plutonic than others, and afford a link connecting the more dissimilar. Trachyte, one of the trap-rocks, is of this kind. Even fragments of granite itself have, it is said, been thrown up by some volcanoes. It has been supposed that a modern volcanic vent may be one end of a great chimney, which leads down to plutonic rocks, through intermediate rocks of the trappic class, probably the older part of the volcanic series.

Trap, from a Swedish word signifying 'stair,' was a name given to certain igneous rocks, from their forming flat masses, one above the other. Trachyte, greenstone, porphyry, and basalt, are the best known of trap rocks. They are composed of the minerals felspar and hornblende, which occur in many varieties. Some of the names originally applied to trap rocks have been extended to modern volcanic rocks; thus lavas are said to be basaltic, trachytic, and porphyritic, from certain resemblances to the rocks of the trap kind. The use of the term porphyry is most frequent in this way. Porphyry originally meant *red* rock; but all rocks

* Geology, Cab. Cyclop.

are now said to be porphyritic which are of a compact basis, with the grains of some one mineral appearing scattered in a conspicuous manner through it.

Trap rocks are found penetrating formations of every kind in dykes, and they also occur in horizontal beds between strata, resembling lava currents. The absence of the beds of loose matter which are found during modern volcanic eruptions, may be accounted for as being the effect of denudation. Many of the volcanoes of the trappic period were probably submarine, and the conical vents, and loose ashes, and scoriæ, which we see in modern times, but do not see in connection with the currents of trap rock, may have been removed in the same way as have been those of Graham Island and other islands, temporarily raised above the sea in modern times by volcanic forces, and afterwards washed away by the ocean. Ashes and scoriæ do sometimes occur with trap rocks. In Shropshire, for instance, such beds occur where trap rocks intrude into the lower silurian strata. Trap rocks occur abundantly in dykes penetrating the coal strata of Great Britain. In the Western Islands of Scotland, this kind of rock is said to overlie the lias, and on the north-east coast of Ireland it overlies even the chalk. Some of the rocks of this class assume very peculiar appearances, particularly basalt, which sometimes takes a very regular columnar form—in the Giant's Causeway, and the caves of Staffa, for instance.

In passing from the trap rocks to the products of modern volcanoes, the change is as gradual as in proceeding from the plutonic rocks to the trap. Thus, in France, Spain, Germany, Italy, and Hungary, volcanic hills occur which bear great resemblance to those of modern times, but some of the products of which are trappic.

Modern lavas are composed of the minerals felspar and augite (a mineral which is, probably, only one form of hornblende), and therefore differ little in mineral composition from trap rocks, with reference to which they are generally classified. Thus they are divided into trachytic, greystone, and basaltic lavas; the first division being that which contains most felspar, the last containing most augite, and the intermediate division containing the two in about equal proportions.

The products of modern volcanoes are not unfrequently so discharged as to imbed organic remains, and thus carry within themselves evidence of their age, such as are rarely found in igneous rocks of other ages.

The varieties of volcanic products are numerous. In addition to lavas of different varieties, there occur scoriæ, pumice, and conglomerates (known as tufa and breccia). Such products are sometimes discharged in great abundance. During the eruption of the volcano of Coseguina, in Central America, hot cinders and scoriæ were thrown out in such abundance as to cover the ground to a depth of more than ten feet, and for a distance of eight leagues from the crater. At a distance of 1100 miles from the point of eruption, a vessel sailed 40 miles through floating pumice. Frequently hills, and sometimes mountains, have been formed by such ejected matter. Perhaps the most remarkable instance of the latter is that recorded by Mr. Stephens as having occurred in Central America, where a mountain, named Izalco, has been raised, in the space of forty-one years, from a small orifice, "puffing out small quantities of dust and pebbles" to a height of 6000 feet. Much of the matter ejected from modern volcanoes is so light and incoherent as to be easily washed away, and no doubt furnishes some of the material for fossiliferous strata now in course of formation.

Geographical distribution of Volcanic Rocks.—When we subtract the hypogene rocks from the areas on the surface of the globe, occupied by rocks of igneous origin, we leave comparatively small spaces to the volcanic rocks. Igneous rocks, later than the plutonic, occur generally either in narrow bands or isolated points on continents, or in islands on the face of the ocean, the only striking exceptions being in Central Africa and in Hindostan, where large areas are composed of such rocks. With regard to their localities, it is remarkable that they occur on islands and seaboards much more frequently than in the interior of continents. When they occur on continents, they are, proportionately, much more numerous among the hypogene rocks than those of later date. They appear very rarely to penetrate rocks more recent than the secondary formation. The same rule appears to hold in regard even to islands which at first sight appear exceptions. For the islands of the Indian Ocean, where volcanoes are particularly abundant, are for the most part composed of hypogene rocks. If it be supposed that those areas, where the hypogene rocks appear at the surface, are those parts of the earth where the upheaving powers of nature were formerly most powerful, the fact of volcanoes being most frequent in those places leads to the conjecture, that these powers continue to reside in nearly the same localities.

The number of active volcanoes at present known is 270, of which about three-fourths occupy the shores or islands of the Pacific Ocean. The Atlantic Ocean and Europe do not include more than fourteen or fifteen. The continent of Africa is not known to contain a single active volcano. The heights of active volcanic mountains vary from 500 feet to 22,000 feet. They are peculiarly abundant and lofty in the chain of the Andes, in South America. Compared with these, Vesuvius (4,000 feet in height) appears almost insignificant, and even Etna (nearly 11,000 feet) takes a low place. It is not, however, the most lofty volcanic mountains which are most formidable; for *they* seldom emit anything but smoke and ashes. It would seem as if the force below did not suffice to raise heated lava to the greatest heights. In Etna and the Peak of Teneriffe, it is observed that lava more frequently flows from lateral craters than from the summit; and lava flowing from lower orifices is more liquid than that proceeding from higher points. For a full account of volcanoes, a paper in the "British Quarterly Review," No. 26, may be consulted.

Practical importance of Igneous Rocks.—The importance of this series of rocks in the arts, resides chiefly in the metamorphic rocks; for it is in these that are found the principal metallic veins. They, and the granitic rocks below them, furnish the chief supplies of gold, silver, tin, and copper. Iron and lead also occur in them, though equally among rocks of later date.

Plumbago, the mineral known as black-lead, is found chiefly among igneous rocks. The black-lead of Borrowdale, in Cumberland, the finest yet discovered, occurs in greenstone and porphyry.

Igneous rocks have also considerable value, independent of that given to them by the foreign matters they enclose. Thus, clay-slate furnishes roofing slate; plutonic and volcanic rocks supply good stone for buildings, roads, and works of art. Verde-antico and statuary marble occur interstratified with metamorphic rocks. It does not appear to be the oldest of the igneous rocks only which yield valuable substances. The production of the precious metals appears to be a usual result of that chemistry by which plutonic rocks of all ages are made; for in the most recent granite—that, namely, noticed by Mr. Darwin in the Andean chain, which is ascribed to the tertiary epoch—"numerous veins of iron, copper, arsenic, silver, and gold" occur. Modern volcanoes do not furnish any substances of much practical importance.

THE ROYAL ACADEMY.

Among the number of exhibitions in which the general public may now cultivate a commendable taste for fine art, the ancient school which gave birth to, if it have not fostered them, retains its place of pre-eminence. This is, no doubt, owing to the corporate nature of the institution, and to the prestige which a life of eighty-four years furnishes. Notwithstanding the absence, this year, of many old favourites—(among whom some degree of surprise has been expressed to find the names of Sir Charles Eastlake, the president, and Sir Edwin Landseer)—the present collection in Trafalgar Square is one in which, although it is impossible to point to any particular work as carrying away the palm, there are to be found a great number of works of more than ordinary ability, and a greater number than usual of high promise. The contributions, moreover, of several foreign artists appear upon the walls, and add not a little to the general excellence of the paintings. A picture of "Florinde," by F. Winterhalter (exhibited by permission of her Majesty), is calculated very greatly to increase the artist's fame, if not to originate it, in England, where he has hitherto been known but as a royal portrait painter. Notwithstanding a mannerism traceable in the several female countenances, and in the colouring of the nude figure, it would be difficult to place any other picture in the collection before it. Another painting, by H. Kretzschiner, of "Prince Waldemar of Prussia, at Ferozeschah, supporting his dying physician, Dr. Koffmeister, who was shot there," is to be welcomed as exhibiting great merit in the drawing, as well as in colour and composition.

Looking at the works of our native artists, two subjects appear to have claimed more than ordinary attention this year, namely, the scenery of Venice, and that connected with the poet Wordsworth; or, among the models, suggestions for monuments to him. These models and the scenery of the lakes are, however, insignificant and unworthy in comparison with the thought that dictated them. But Venice is *une autre affaire.* Why? There are no less than twelve or thirteen pictures taken of this little island-city, and scarcely one of them undeserving of some notice. Above all stand forth the two only works which Mr. Edward William Cooke, one of the new associates, exhibits, both properly placed on *the line*, and each immeasurably superior to everything of the kind. This artist appears to be devoting his exclusive attention at present to Venetian scenery, as he did lately, with no less success, to Dutch. When we were recently at Venice, we found he had already, from a local reputation raised by his oil-sketches of scenery on the lagoon, obtained the name of IL LAGUNETTO; and we observe he appends this name to his

present two pictures. In 405, the Doge's Palace, on the right, is rendered with almost microscopical exactness of design and finish, and fully justifies the name which Mr. Cooke has acquired at home among his brother artists, as the greatest draughtsman of the age. 526 is more among this artist's old subjects, and displays evidences of having been painted on the spot. The great charm of Mr. Cooke's productions, this year and the last, consists in his treating so familiar a subject as Venice, with nothing but its own splendid tones and harmonies of colour, and thus, by attention to *truth* alone, observing all the conventionalities of painting, from the Canaletti downwards. Mr. Roberts, R.A. (34), contributes a cold general view of the city, but it is by no means in his best style, or treated with care. The water is ice. The Foscari Palace, by W. Linton, might be a copy of a Canaletto, with everything to be desired in the atmosphere and detail of the building. 1108, by G. B. Moore, a "Night View of the Island of St. Georgio Maggiore, from the Piazzetta of St. Mark," has a novel and pleasing effect; and the "Baptistry of St. Mark" (1243), and the "Principal Entrance to the Ducal Palace," are very elaborately drawn by C. Sprosse.

There is one feature of the present exhibition which excites remark, in addition to the absence of Sir Charles Eastlake and Sir Edwin Landseer, in the very height of their fame and power, namely, the number of R. A.'s who contribute only one picture each. Dyce, Leslie, Mulready, Maclise, Marshall, each have but one painting upon the walls, and none of the best. The place of honour is given to Mr. Maclise's picture, representing "Alfred, the Saxon King (disguised as a minstrel), in the tent of Guthrum, the Dane." It shows his knowledge of drawing and composition, but is destitute of many beauties with which the public have been made familiar in his earlier works. 371 is an "Interior of the Cathedral of St. Stephen's, Vienna," by Roberts, R.A., and is one of his best specimens. 69, by the same master, "Antwerp," is rather a sketch than a picture. We cannot help remarking, *en passant*, that pictures, intended for pictures, should not be mere sketches. A picture should be a finished production, elaborated to some degree, or, at least, not negligently or carelessly executed, especially where masses of building are represented, and whose life is detail. Stanfield, R.A., contributes two productions in his old style—48, "The Bay of Baiæ, from the Lake Avernus;" and 190, "The Port of La Rochelle,"—both admirable. Even he exhibits only one other picture. Among the paintings of Mr. Webster, R.A., are particularly to be noticed—60, "A School Play-ground," destined to be a prime favourite where it is now placed, and wherever it may find a place. Wilkie did nothing better. 153, "A Letter from the Colonies," is another work of great merit in conception and execution, from the easel of this gentleman. Mr. Redgrave, R.A., both attracts and repels us in his two pictures—22, "The Woodland Mirror," an exquisite work; and, 263, "Love and Labour," a very formal piece of business indeed, and, in every respect, quite a mistake of the artist. To look at it, is to criticise it in every part. On the whole, the R.A.'s do not come off so well. The Associates are treading on their heels. Mr. Frith, one of them, has here some very clever and carefully-painted things. 336, "Pope makes love to Lady Mary Wortley Montagu," is admirably drawn and coloured, and tells the story with *all its results*. Mr. Ward, again, has nearly obtained the palm this year in 316, "Charlotte Corday going to Execution." It is sufficient to say of this, that all the press have united in its praise, barring one or two points of minor importance. Mr. Frost, A., appears in his wonted style, highly pleasing in subjects and treatment: 315, "May Morning," is novel and refreshing, and his other pictures are above par. Mr. Lance has a larger picture than usual—227, "The Seneschal," displaying all his ordinary and extraordinary richness and truth of colouring. We have seen better specimens of Mr. Hannah's skill. Such careful pencilling as he is capable of, deserves better subjects than has claimed his attention in the only two pictures he has sent—572 and 573. Mr. M'Innes's pictures are still wanting in power. He can deal with a sweet face as well as any artist of the day, and he has evidently studied his subjects with care. The tameness of which we complain in his pictures, particularly 212 and 540, is to be got over. Our old friend, Stark, has sent several specimens of his transcripts of natural scenery: 1127, "A Country Churchyard," serving as an illustration of "Gray's Elegy," is a particularly good example of his peculiar power. 1262, "Rest from Sport," by his son, displays great promise. The dogs and dead game are very nicely put in. We would recommend this young artist to confine his attention to animals, in which he appears to excel, provided his taste leads him that way. But let his studies be larger. The present one is a miniature.

There are some honorary contributors, as usual; but, with the exception of (1140), "Greenwich from the River," by H. Cundell, there is not much to the credit of any. This is really a clever "bit."

There is a very remarkable medal by Mr. Wyon (634), struck by order of the Corporation of the City of London, to commemorate the opening of the New Coal Exchange. It is in bronze, with, on one side, likenesses of Prince Albert (the very best we have seen in such a form), and of the Prince of Wales and Princess Royal, disposed in a triangular position, with representations of the scenes of the opening between. Nearly the whole of the reverse is occupied with an *intaglio* of the interior of the building—something novel in medals. It is every way deserving approbation, as well for the boldness in conception as for the felicity of execution.

There are, as usual, a great number of portraits, among which may be named the following:—The Right Hon. B. Disraeli, M.P., Chancellor of the Exchequer; Lord Truro; the Earl of Aberdeen; Sir Charles Napier; The Chisholm; The Archbishop of Canterbury; Colonel Sykes; Thomas Bazley, Esq., President of the Chamber of Commerce at Manchester; Alderman Salomans; Sir Fitzroy Kelly; Dr. Hooker; Sir Chas. Eastlake, P.R.A.; the Hon. Mrs. Norton; the Hon. and Rev. Baptist Noel; Douglas Jerrold; Cardinal Wiseman; the Duke of Wellington; Lord John Russell; W. C. Macready; Albert Smith; Sir Harry G. Smith, Bart., &c.; while there are busts of Professor Whewell —an admirable one by Bailey, R.A.; T. Carlyle; Beethoven, &c.

The most important of all the pictures are, however, those coming from the easel of the parties to whom the name of Pre-Raphaelite has lately been given. It is no longer to be doubted that great genius originated this new class of paintings. Above all, Mr. Millais stands pre-eminent. 178, by him, "A Huguenot, on St. Bartholomew's Day, refusing to Shield himself from Danger, by wearing the Roman Catholic Badge," is a charming production. There is nothing comparable with the expression in the two faces, but particularly the female face, in the whole gallery. The mixture of maidenly fondness, terror, and anxiety, is happily shown; while faith, rejoicing in its own impulses, characterises the Calvinist. "Beech Trees and Fern," again, 107, on another subject, is a very excellent production, by Mr. M. Anthony. There are points in all the other paintings in this style much to be commended, although some of them, by the "imitators," are simply ridiculous. It is unquestionable, however, that a new school is rising; and the authorities at the Royal Academy are to be praised for giving it every reasonable facility on their walls for the display of its powers and its promises.

MIRRLEES' SUGAR-MILL.

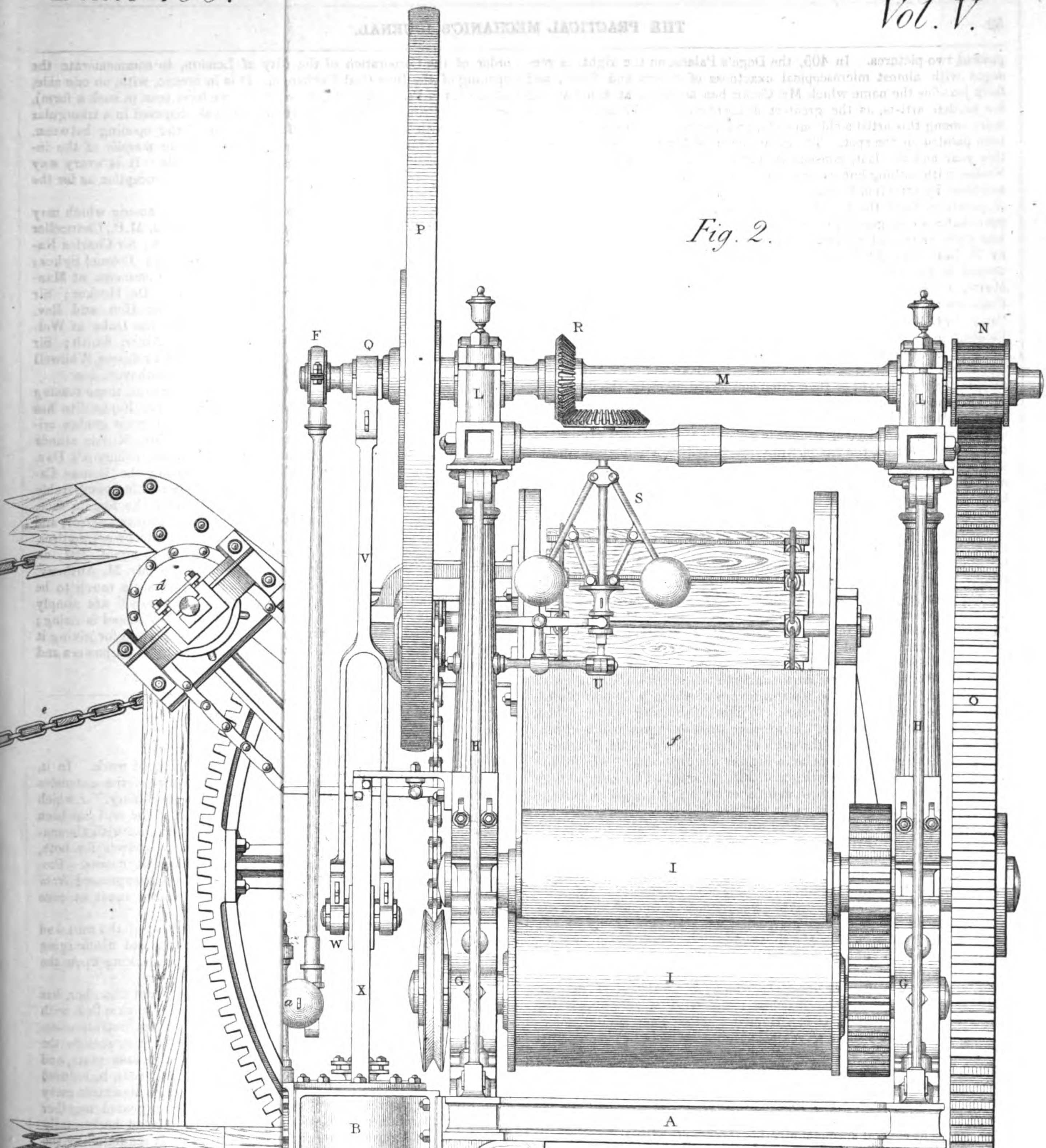
(Illustrated by Plate 100.)

A good design is well combined in this mill with good work. In it, the patentee, Mr. J. B. Mirrlees, has made good use of the extensive practical experience in this class of manufacturing machinery, for which his firm has deserved and won so high a reputation. The mill has been contrived with the view of combining the actuating engine with the machinery in such a manner, that the same framing may answer for both, thus getting at compactness and stability by very simple means. Provision is also made for heating the cane-juice as it is expressed from the rollers—an arrangement which every sugar-planter must at once appreciate as an important agent in his process.

Our 100th plate furnishes, in fig. 1, a front elevation of the mill and engine complete, with a portion of the cane-feeding and discharging gear. Fig. 2 is an elevation at right angles to fig. 1, looking upon the discharging end of the rollers.

The base plate, A, which is hollow, to serve as a steam chamber, has bolted to it on one side the steam-engine cylinder, B, supplied with steam by the pipe, C, and stop-valve, D, and having its outside slide-valve, E, worked by a vertical rod from the eccentric, F, outside the crank overhead. Two standards, G, are fitted to the base plate, and are further secured by the two diagonal wrought-iron tie-rods, H, secured to the base plate by keys. The lower portions of these standards carry the bearings for the three crushing rollers, I, which are geared together in the ordinary manner. The two side rollers are adjusted horizontally by means of the screws, J, and the upper central one is regulated by the cutter, K. On the top of these standards are cast the two plummer blocks, L, fitted with brasses to receive the journals of the main driving shaft, M, of the engine. This shaft carries a pinion, N, outside the framing, which pinion gears with the large spur-wheel, O, keyed on to the shaft of the central crushing roller of the mill. By this arrangement, the power is communicated from the driving shaft directly to the crushing rollers; but it is clear that, in other modifications of steam-engines, a train of wheels may be required in place of the simple large spur-wheel used as described. A heavy fly-wheel, P, is keyed on to the opposite extremity of the driving shaft. Immediately in front of the driving wheel is the crank, Q, and eccentric. A bevel wheel, R, keyed on to

Fig. 2.



W. Johnson. Patent Offices.
London. Glasgow & Edinburgh.

Engd by H. Adlard.

the driving shaft, gives motion to the governor, S, which regulates the throttle-valve, T. The governor works in the light brackets, U, bolted to the side standards of the framing. A forked connecting-rod, V, is attached in the ordinary manner to the crank by a strap and cutter, and the extremities to the two sides of the slide, W, which is attached to the end of the piston-rod, and works in the vertical guides, X, bolted to the cylinder. Two short upright pillars, Y, are bolted to the top of the valve-chest, and they are connected at their upper extremities by a cross bar, through the centre of which works the valve spindle, Z. The slide-valve receives its movement directly from the eccentric, and the weight of the slide is counterpoised by the small weighted lever, *a*, which works in a fixed bearing in one of the pillars, Y. The ordinary stop-valve, D, is placed close to the cylinder, thereby affording great facility to the attendant in stopping the engine when required. The base plate is cast hollow, and its upper surface is of concave section, to receive the juice of the cane; and the waste steam of the cylinder is made to pass into the interior of the base plate, the cylinder being formed with a side branch for that purpose. By this arrangement, the juice is kept hot in its way to the boiling apparatus, without any cost in the way of fuel.

The feed apparatus is worked from the pulley, *b*, on one of the lower roller shafts; an endless chain, *c*, from this pulley being passed over the elevated pulley, *d*, the shaft of which actuates the endless chain of feeding laths, *e*. From this feeder, the canes, as supplied by the hands of the negroes, are conveyed down the inclined channel, *f*, to the rollers; after passing through which, the "cane trash" or "megass" is carried off by the endless lath belt, *g*. The endless chain, *h*, which actuates the discharger, *g*, is driven from another outside pulley, *i*, from the roller-shaft on that side of the mill. Messrs. M'Onie and Mirrlees construct the same kind of mills, under various modified forms of gearing; as, for example, with the crank-shaft beneath instead of overhead,—or with double gear, in place of the large spur-wheel on the centre roller-shaft. This general arrangement of sugar-mills also affords great facilities for the erection of the heavy parts, as the elevated standards may be used instead of triangles or other supports for hoisting. The framing of the mill being also the framing of the entire engine and gearing, the combined arrangement is very little liable to strain or derangement from that very common and very serious evil, the subsidence of the foundations.

SCIENCE.

I.

The progress which has taken place in man's dominion over all nature is, in the present age, so thrust before the attention of even the most careless, as to excite astonishment and delight. Those benefits and pleasures which, in an early stage of society, were reserved for the solitary magician or wizard, as he was called at different times and in different places, have been gradually disseminated, until human power has increased in the more civilised nations to such an extent, that those benefits and pleasures have become the property of the million. Barbarity has given place to comparative civility, and the war which, in all the past, has been waged in the mind between truth and error, or, to speak more correctly, between assumed truth and assumed error, is terminating in a peace. The ineradicable nobility of human nature has shown itself breaking the bonds of dogmatism, and even the most ordinary individual will is bursting from its embryo existence, and entering on what may be called a new state of being. The thraldom of early opinion, and the more debasing slavery of imagination, as it has been improperly applied, are passing into oblivion, and each individual is slowly but surely beginning to enjoy the liberty of realities. The truth which has, for ages, been known, but unconsciously more or less concealed, that all external nature is the subject of human power, is becoming appreciated and acted upon. The tyrannical governments and sanguinary codes of laws of almost forgotten ages, are yielding to the milder legislature and executive of modern times; and this is strictly true, even where something rising on the surface of neighbouring nations might lead one to fancy the contrary. The instrument of navigation, from the rude canoe, roughly sculptured from the solid tree, has been transformed into the magnificent steam-ship. The unwieldy machine of locomotion on land, traversing the rough and unformed road, and drawn by the bullock or the horse, has given place to the elegant and comfortable railway carriage, conveying us from spot to spot often at the rate of a mile a minute. Commerce, from the mere barter between contiguous friendly people, is now hourly hurrying over the length and breadth of the world, and antipodal, and but lately antagonistic nations are reciprocating good. The voice of right confidence is beginning to speak, and faction and controversy are hiding their heads at its sound. Bare knowledge is giving the palm to wisdom, and the better heart and enlarged mind are gradually taking their proper places on the throne of individual existence. Mind is shedding its light upon all human activities, and the consequence is—proper progressive industry. "Truth," says the proverb, "is the daughter of Time," and the present age of human life looks upon her with the affectionate solicitude of hope, untrammelled with the fear of her participating in the falsehood and vices of its own youth.

The progress which has thus observably taken place, has resulted from man's first observing a fact, and then boldly asking himself the question, "Why is this or that as it is?" and answering it, if a physical fact, by penetrating below the surface of external things; and if a fact of consciousness, then into the depths of his own, and therefore of human nature. By observation and experiment—which is the Drama of observation—law after law, regulating apparent truths, and reconciling imaginary discordances, has been thus discovered; and every subsequent discovery has been a step gained. This progress has been effected by what is called "Science."

So great in extent is the subject, that, within our narrow limits, it is totally impossible to say all that might be said about it. We must, therefore, confine ourselves to some few remarks upon the nature and objects or aim of science, and upon some of the many benefits and pleasures which have accrued from its cultivation.

In the light in which it has presented itself to us, science is more readily described than defined. We are not fond of definitions. Like many theories and hypotheses, they have often been found to mislead, and definitions, upon the principle of etymology, are daily becoming more insignificant. The best, and perhaps the only useful definition of anything, is that which the individual conceives of such thing within his own mind, by reflection upon the learned culture which he has made his own respecting the thing. Nor is this mode of definition really difficult, or so seldom acted upon as might at first be supposed; for it is demonstrable that, for one definition which he receives at the hand of other persons, every individual has, in his own mind, framed—and correctly framed too—a multitude. We will not, therefore, attempt to define science, but rather choose to leave to personal reflection the task of framing such a definition from the nature of science, as it presents itself to the reader.

Creating a smile as it may, the observation is, nevertheless, true, that every one is a philosopher or scientific person in *his own way*, although he may be unconscious of the philosophy or science which actuates him. We may add a further remark, that every one has attained his science or philosophy, whether true or false, in the most simple manner. Newton, the sharer with Leibnitz in the discovery of fluxions—the sole promulgator, to all ages, of the law of the decomposition, as it has been called, of light, and of the highest generalization which has ever been made in physics—we mean, of course, the doctrine of gravitation—after a long life passed in profound observation and reflection upon nature, a short time before his death, said to a friend, "I do not know what I may appear to the world; but, to myself, I seem to have been only like a boy playing on the sea-shore, and diverting myself in finding, now and then, a smoother pebble or a prettier shell than ordinary, whilst the great ocean of truth lay all undiscovered before me." Now, it is the character of science that every one of her votaries must approach her, if at all, in her presence-chamber of nature, with the simplicity and docility of such a child. All inquirers into truth will readily admit themselves to be such children—indeed, they can do no other—and though they may not, like Newton, have made their discoveries public, it is our opinion that many such discoveries are made—particularly in moral and mental science—and that each discoverer, although he may be occupying what is called a mean station in life, has thoroughly and heartily sympathised in spirit with this memorable declaration of that mighty genius.

The observation of facts is the foundation of science. Facts, and recorded observations of facts (which all by due patience and industry may ascertain *to be* facts), form the only alphabet and library of the philosopher, in whatever department his activity may be exercised. The motto of every student (and every one ought to be a student from his cradle to his grave) is, "Observe." Nature, by the instrumentality of the senses and consciousness, presents before every mind her "infinite book of secresy," from which alone these facts can be elicited, and which, being brought to the bar of individual judgment, can be declared to be true or false, or, to speak more strictly, to be, or not to be, facts. We may here state, that when we thus use the word "observe," we would infer a mode of exercising the senses *with thought*. Seeing only—hearing only—is not our meaning; but seeing and hearing thoughtfully—exercising the senses with an *intentional* accuracy pointed by the mind—receiving the impressions of things in all their known analogies—influenced by all circumstantial facts and all their appreciable laws. Thus, the prime

business of the man of science is to read facts with the same views as Bacon tells us we should read books—not to find talk and discourse alone, but to weigh and consider;* and it may be added, to raise in one's self additional power. Hence the importance of facts, or, using another word, realities, must be sufficiently recognised.

To observe a fact, and to communicate it to others, has hitherto alone claimed the name of discovery; but, in truth, to observe is to discover, and this in an important sense as regards the individual being the true foundation of his very designation as such. All persons, from time immemorial, doubtless, have observed more or less; but it is because few have thought it essential to communicate their observations, either to the world without or to the world within, that science of the present day, although far advanced in comparison with what is yet known of earlier times, is, probably, in its first steps on its pilgrimage through nature. New facts, new realities, are in the power of every one to impart; and less or greater benefit and pleasure must attach to the communication, as it may be in further proof of received truth, or ancillary to the ascertaining of truth as yet unacknowledged.

Every discovery of a law of nature is traceable to the observation and promulgation of one simple fact; and had that fact not been observed, such discovery and all its results could not have taken place. For one leads to another, until such a general law (which is in itself but a more important fact) is noted. Galileo observed a lamp swinging on its chain from the roof of the cathedral at Pisa. It had doubtless done so, at times, for many years; but he *observed* it. Although young at the time, his scientific and penetrating mind immediately connected it with certain preceding, perhaps indefinite, observations. On his own pulse he, at once, made an experiment which was suggested to him. He observed that the lamp appeared to oscillate in equal times. He was not quite correct in this, but he had made so important an observation that the pendulum was invented. The laws of the oscillation of the pendulum were afterwards discovered by Huyghens, the celebrated mathematician, who completed that application of it to the regulation of our present clocks, and to many other still more important purposes,—among which is that very interesting one, the ascertaining and fixing a just and natural standard of long measure, to which we intend presently again to refer. The well-known story told of Newton (which, if apocryphal, as some writers say it is, possesses a characteristic of truth), who observed an apple fall from a tree, is another instance. This simple fact, sown like a seed in the fertile ground of his mind, just at the proper season, and gradually there growing to perfection, enabled him, after one of the most patient and philosophical inquiries which have ever been made, to apply the principle of the descent of the fruit, or rather of its attraction by the earth, to all the planetary system. Had the lamp in the one case, or the apple in the other, not been *observed*, who may say in what an unadvanced state the science of dynamics, and therefore of astronomy, might now have been!

Hence men of science, on all subjects, are, or should be, but the detailers of facts, whether they are simple or general. It is only from the known that we can reason to the unknown; and prior reasoning must ever yield authority to subsequent reasoning, if one simple fact be found opposed to it. Hence, also, to the non-observance or negligence of facts, are to be ascribed all false systems—all false theories—all false philosophies. The mind is, by its own nature, so in love with order, when first conscious of its character, and so eagerly grasps after that certainty which induces pleasure and peace, that, from the notice of a few scanty facts out of the millions that claim its careful observation, it, in overlooking its original humble position, flies up with waxen wings to the sun, and, by a law of nature, necessarily falls. Not so the mind of the disciple of true science; or, if it find its imaginary truthful flight but slightly arrested, it applies itself more closely, more deeply, to the investigation of the appearances, and absolute truth or error is the result.

To discover error, or, in other words, what is not yet known to be the true, is, therefore, equally important with the discovery of the true. For the discovery of error in one thing is often the discovery, or leads to the discovery, of truth in another. Indeed, the discovery of error is sometimes more important, and always more noble, than the discovery of truth. For the discovery of error implies that honest and zealous search after truth, which can alone overcome the enthralling dominion of prejudice.

The greatest attention of the scientific man is devoted to seeing that his facts are correct—are real and incontrovertible—and that no opposing fact appears, before he begins to generalize or infer a general law regulating all. He who first observed in one seed of a plant the fact of its unity of structure, directed his eye to other seeds, by which the great generalization was afterwards made (of all but a few plants, the seeds of which have not yet been detected), of those whose seeds have only one lobe, as in wheat, and thence called the monocotyledons, and of the dicotyledons, or those whose seeds have two such lobes, as in the bean. This generalization was, subsequently, confirmed by the observation made of the monocotyledonous plants increasing in size from the centre of the stem, and the dicotyledonous growing by means of successive layers of woody fibre on the exterior immediately beneath the bark, and which gave rise to the names, *endogenous* and *exogenous*: the endogenous, as in the bamboo cane—the exogenous, as in the oak; while a climax of confirmation of this singular division of vegetable structures has resulted from observing the leaves of plants, the monocotyledons, or those of endogenous structure, possessing veins extending longitudinally from the stalk to the point of the leaf, as in the grasses; those of the other class exhibiting fibres reticulated, as in the ivy. We must still be careful how we proceed. For simple observation has led to the promulgation of an opinion—and certainly, to a person before ignorant of it, to an astounding opinion—of the sexual character of plants. This has induced some naturalists, and with apparently harmonious probability, to infer the identity of plants and animals, as but modified structures of the same one organic life. For distinct provision has been stated to have been discovered for generation, respiration, growth, secretion, digestion, excretion, and dissolution in plants, somewhat analogous to similar functions and laws in the higher forms of being; and why not strictly so? It is pure imagination, however, that asks the question, and not science; for some facts, apparently opposing this view, have been observed. Thus science deals with facts alone, and not even with strong analogies; and before further observations are made, which may confirm or annihilate this curious hypothesis, science withholds her sanction; and it remains but as one of many other points, which, in all their investigations, the botanist and zoologist must bear in mind.

* Essay of Studies.

AYR DREDGING MACHINE.*

SPECIFICATION OF HULL.

General Dimensions.—Extreme length of vessel 80 feet; extreme breadth moulded, at stern 23 feet, at luff of bow 22 feet, with a round of 6 inches between; height from under side of floors to top of deck beams, at sides amidships, 8 feet; round of deck 6 inches; sheer of deck, aft 6 inches, forward 1 foot; rise of floor 3 inches; bucket well 48 feet long and 4 feet wide; overhang of upper tumbler 6 feet.

Keels.—Four keels of American rock elm all the length of the vessel, besides a mid keel in one length from well-head to stern, 12 inches deep and 10 inches thick, except those at the well bilges, which are 12 inches square; of the four keels, three are in two lengths each, and one in three lengths; the joinings breaking joint at least 10 feet, and formed with scarfs 5 feet 6 inches long, with lips 2¼ inches thick; the joint vertical, with felt between, and caulked with a thread of oakum, and a strip of lead tacked on above a piece of felt with copper tacks; every scarf fastened with two bolts $\frac{1}{16}$ inch diameter at each lip, and four bolts $1\frac{3}{16}$ inch diameter between, reeled and dowelled with two turned teak cogs 8 inches diameter, let 1½ inch into each side; the bolts clinched on washers.

Stem.—The stem of British oak, sided 10 inches, moulded at top 11 inches and at bottom 13 inches, extending from 2½ feet above deck to keel, on which it is scarfed, bolted, and fixed with two dovetailed plates, each 2 feet long by 3½ × ¾ inches.

Apron and Deadwood.—The apron of British oak, sided 14 inches, moulded 6½ inches at top and 9 inches at bottom; to extend from the upper breast hook to about 3 feet above mid keel to scarf on deadwood of British oak, sided 14 inches, moulded at ends same as apron and first floor, on the latter of which it butts; the stem and apron fastened with ⅞ inch bolts not more than 30 inches apart, and the deadwood extra bolted; the ends of all the bolts clinched on washers.

Stern.—The lower angle of the stern formed with 5 logs of British oak, each in one length across the stern of the vessel, and extending 3 feet 6 inches along the bottom and as far up the end; the angle log 14 inches square, the two on each side thereof 12 inches thick, and the other two 10 inches thick each, all bolted together with seventeen bolts 1⅞ inch diameter, and secured at the bilges with strong iron knees; the remainder of the stern 7½ inches thick, and of red pine, in one length from well to outside planking, and the whole of the stern fixed together with six through bolts 1¼ inch diameter, and clinched; where the logs pass through the well they are chamfered and rabetted for 3 inch oak planking clinch bolted on logs and rail, and a keel fitted in transversely between the two well keels for additional strength to stern tie.

Floors.—The floors all of British oak, in one length from bilge to bilge, and fastened to every keel by clinched bolts ¾ inch diameter, and about 21 inches long; the berth and space 2 feet, moulded 10 inches at the middle and 7 inches at the outer bilges, and sided 9 inches from bow to 10 feet abaft of well head, and the rest 8 inches.

Keelsons.—The keelsons (unless otherwise specified) of Quebec red pine, 12 inches deep and 10 inches broad. The two well keelsons extending from stern to fore-end of boiler in two lengths each. The centre keelson extending in one length from fore-end of well to apron. The two waist keelsons in one length each,

* See *ante*, page 28, Vol. V., *P. M. Journal.*

extending from fore-end of boiler to 20 feet abaft of well head, tapering down at the after end to thickness of ceiling plank. The two lower bilge keelsons extending from luff of bow to stern in two lengths each, and rounded to fit timbers; and round the bow of British oak, sided 9 inches and moulded 12 inches, in two lengths on each side, scarfed 3 feet, and fastened with four $\frac{3}{4}$ inch bolts, clinched. The two upper bilge keelsons in two lengths each, extending from luff of bow to stern, and chamfered on the inner edge. The keelson scarfs similar to those already described for the keels, and so arranged that they shall break joint at least 10 feet with the keels, and with one another, and be thorough bolted through floors and keels.

Engine Bearers.—Two beams of British oak, each 9 inches square, securely bolted to keelsons for sole-plate of engine, and double checked at the larboard side into bilge keelsons there.

Futtocks.—The futtocks of British oak, sided $6\frac{1}{2}$ inches and moulded at ends same as floors and side timbers, and extending 3 feet on bottom planking, and 4 feet on side planking. One in every fourth space between stern and well head, to luff of bow one in every alternate space, and to stem one in every space.

Side Timbers.—The main side timbers of British oak, berth and space 2 feet, sided at gunwale $4\frac{1}{2}$ inches and at lower end $6\frac{1}{2}$ inches, moulded at gunwale 4 inches and at lower end 7 inches, and extending in one piece from covering board to floors; the intermediate timbers placed one in every space between main side timbers, and of the same scantling and material as they are, extending in one length from covering board to keel, except at the futtocks, on the top of which they scarf 15 inches, the lips of the scarf being not less than $1\frac{1}{2}$ inch thick; the side timbers to increase 1 inch on the sided and moulded scantlings between the luff of the bow and the stem. A British oak side timber, 2 inches larger each way than main side timbers, fixed into each of the two outer angles of the stern, to which it is attached with $\frac{7}{8}$ inch screw bolts 2 feet apart; and an oak timber fitted about midway on the stern planking and butt on stern log, for a timber head.

Knightshead.—The knightshead all British oak, and formed with bollard timbers, extending $2\frac{1}{2}$ feet on each side of stem, moulded $5\frac{1}{2}$ inches at upper end and 8 inches at lower end, and securely bolted to apron; the upper end of these timbers tenoned into a breast hook 8 feet long, sided 8 inches, and moulded at centre 12 inches and at ends 8 inches, and securely bolted to timber heads of same dimensions as bollard timbers.

Breast Hooks.—Three breast hooks of British oak fixed under the deck, each 15 feet long, sided 10 inches, moulded 12 inches at centre and 8 inches at ends; each fixed with a $\frac{7}{8}$ inch clinched bolt in the centre, and a $\frac{3}{4}$ inch screw bolt at every timber on which it is fitted.

Stringers.—The stringers $5\frac{1}{2}$ inches thick and 11 inches broad, of red pine, in two lengths on each side, from stern to luff of bow, and of British oak in two lengths on each side, from luff of bow to stem, where they scarf on upper breast hook. The stringers bolted edge on with a $\frac{3}{4}$ inch bolt to every alternate timber, and scarfed as described for keels, only the cogs, felt, and lead omitted.

Planking.—The bottom planking of red pine, in long lengths, 3 inches thick, and not more than 11 inches broad, with a 6 feet shift and one strake between; the joints with butt ends, each on the middle of a floor, fastened thereto with two bolts $\frac{1}{2}$ inch diameter and 10 inches long, and the after ends bolted to stern with bolts same size; and the planks double treenailed with Dantzic pine treenails $1\frac{1}{4}$ inch diameter. The side planking, from bilge keels to wales, $2\frac{3}{4}$ inches thick, the two lower strakes of American rock elm, not more than 8 inches broad, and bolted with $\frac{1}{2}$ inch bolts $9\frac{1}{2}$ inches long, and the rest of red pine, not more than 10 inches broad. The wales or bends of American white oak, in three strakes, each 6 inches broad and $4\frac{1}{2}$ inches thick, and chamfered on the edges. The black strake of red pine, 8 inches broad and $3\frac{1}{4}$ inches thick, and beaded on the edges. The bright strakes of red pine, in two strakes, each 6 inches broad and $2\frac{1}{4}$ inches thick, and beaded. The paint strake of American white oak, $10\frac{1}{2}$ inches broad and $3\frac{1}{4}$ inches thick, and beaded on the edge. The whole of the planking in long lengths, with a 6 feet shift and three strakes between, and the planks butt-jointed on timbers, and fixed thereto with two bolts on each end. The paint, bright, and black strakes, also the wales, single treenailed, and the rest double treenailed; the treenails of Dantzic pine, and $1\frac{1}{8}$ inch diameter, except for the hardwood planks, which are fastened with British oak treenails same size; and the whole of the treenails propped on the outside, and wedged on the inside. The fore ends of the planking rabetted on stem, and bolted thereto with $\frac{1}{2}$ inch bolts averaging 8 inches long, and the after ends fastened to stern with rag bolts averaging 12 inches long, and an additional $\frac{5}{8}$ inch screw bolt through each plank to the angle timber, felt being placed between planking and stern.

Deck Beams.—Four main deck beams of British oak, sided 10 inches, moulded at centre 10 inches and at ends $6\frac{1}{2}$ inches; one placed at fore end of bucket well, and fixed with a $\frac{5}{8}$ inch screw bolt to the after posts of main framing, also one at each end of boiler space, and another before fore hatch; and a British oak beam, sided $7\frac{1}{2}$ inches, and moulded 8 inches at centre and $6\frac{1}{2}$ inches at ends, placed between the fore beam and breast hook. The rest of the deck beams of red pine, berth and space 22 inches, sided $4\frac{1}{2}$ inches, and moulded a parallel depth of $6\frac{1}{2}$ inches. The ends of all the deck beams dovetailed into outside stringer, or outer well plank, as the case may be, or into fore and aft carlins, where bridled for companions or machinery. Every deck beam fixed to stringer and well planking with bolts; the oak beams with $\frac{3}{4}$ inch screw bolts; the red pine beams with $\frac{5}{8}$ inch screw bolts to stringer, and to the well planking with $\frac{1}{2}$ inch rag bolts.

Carlins.—The fore-and-aft carlins all British oak, those for the engine and boiler space being sided 9 inches, and moulded 8 inches, and for stoke-room hatch 7 inches square, all double checked on main deck beams. Two carlins 8 inches square fixed with 1 inch bolts to main deck beams, checked therein $1\frac{1}{2}$ inch for additional strength of bearing to bow crab, and extending from fore end of engine space to bow. The 'thwartship carlins for boiler and engine space and stoke-room hatch of red pine, sided 4 inches, and moulded $6\frac{1}{2}$ inches, berth and space 18 inches, dovetailed on fore-and-aft carlins and stringer.

Coamings.—The coamings of British oak, half checked and bolted at the angles, and fastened every 30 inches with $\frac{5}{8}$ inch bolts clinched; those for the engine-room 10 inches deep by $2\frac{1}{2}$ thick at top, and curved out to $4\frac{1}{2}$ inches thick at bottom.

Beam Knees.—The main beams strengthened at each angle with British oak knees properly fastened with screw bolts, sided 5 inches, and moulded in proportion, and the outer side of those in engine and boiler spaces each bed on a fore-and-aft carlin 5 inches thick, resting on and bolted to stringer.

Tie Bolts.—The vessel is tied at the level of the deck beams with bolts $1\frac{1}{8}$ inch diameter, and extending from outside to outside of planking, and having large washers and clinched ends: three in the bucket well space, at the intermediate main posts; and one alongside of every main deck beam; also four bolts, screwed at both ends, for fore-and-aft carlins of engine and boiler space, the one at after end being grooved flush into beam, and eight bolts, 1 inch diameter, from fore-and-aft carlins to outside.

Main Framing.—The fore posts and after posts of British oak, and the intermediate posts of red pine, 12 inches square, checked $\frac{3}{4}$ inch into keelson, and tenoned into top thereof, and attached to same with a $\frac{7}{8}$ inch screw bolt through planking, posts, and keelson, and at the upper end the top bevelled to suit the angle of the beam, tenoned into same, and fixed down with a stirrup-iron to each, $2\frac{1}{2} \times \frac{1}{2}$ inch, and 3 feet long on each side, fixed with a $\frac{5}{8}$ inch bolt, and two gibs, and a cotter. The fore-and-aft stringers of the main framing of American white oak, 12 inches square, in two lengths each, joined over posts with a 6 feet scarf having lips 3 inches thick, and a hardwood key. These beams are fished on the lower edges with British oak, sided 12 inches, moulded 9 inches at after post, and diminishing with an eye-sweet curve to an edge at ends, fastened to beams with $\frac{5}{8}$ inch bolts 24 inches apart, clinched and reeled, and each end further secured with a hoop of malleable iron $2 \times \frac{1}{2}$, driven hard over fish, and spiked on. Oak fillings, 6 inches thick, fastened at after end of framing for dead eyes resting on. The after stay of British oak, 12 inches broad and 8 inches thick, fixed with a $\frac{7}{8}$ inch screw bolt at each end, and tenoned into and butted on stern and fish; and the after cross tie of British oak 12 inches square, tenoned into stringers, and fixed with long straps with gibs and keys.

Trussing Rods.—The after part of the vessel trussed with four malleable iron rods 2 inches diameter, in one length each; the upper ends screwed against a cast iron plate with snugs, fixed on stringers of main framing, and the lower ends, passing through main posts, fixed with a key in a strong saddle with snug, and bolted on keelson as far apart as possible.

After Knees, &c.—Two knees fixed vertically into the angles formed by main stringers and after posts, of British oak, sided 12 inches, and firmly bolted.

Crank Shaft Beam, &c.—The larboard fore post carried up to the proper level for supporting a British oak beam, 12 inches square, for the outer end of crank shaft, and the starboard end of it fitted on a post 12 inches square, to rest on an extra keelson 12 feet long, and both ends of the beam fixed down to posts with a stirrup-iron with gibs and keys.

Diagonal Struts.—The diagonal struts of British oak, tenoned at both ends, those next the well sides being 6 inches square, and next the outside 12 inches broad and 4 inches thick, fixed at each timber with a $\frac{5}{8}$ inch bolt, clinched.

Well Timbers.—The well timbers of British oak, sided 7 inches and moulded 6 inches, berth and space 22 inches; extending from under side of deck to top of floors or keels, and dovetail checked $1\frac{1}{2}$ inch into keelsons with a taper of 1 inch on each side, and fixed with a $\frac{3}{4}$ inch screw bolt.

Well Planking.—The top strake of the well planking in one length, of British oak, 11 inches broad and 5 inches thick, checked on and bolted to posts of main framing; the lower strake of American rock elm (as well as the two next above it), in one length, rabetted 2 inches on keel, and attached to it with spikes driven horizontally every 20 inches, and vertically with $\frac{5}{8}$ bolts, clinched, every 4 feet apart; the rest of the planks of red pine, not more than 11 inches broad, and uniformly 3 inches thick (which is also the thickness that the three elm planks are to be made), one half of the planks being in one length, and the rest in two lengths, with a 10 feet shift and one strake between. The planks double fastened with $\frac{9}{16}$ inch bolts, clinched on inside, except at the posts of main framing, where they are fixed with $\frac{5}{8}$ inch rag bolts 9 inches long. The fore end of well planked vertically with red pine, 3 inches thick, bolted to floor below and beam above, and also to two oak rails $6\frac{1}{2}$ inches square, bolted at ends to fore posts.

Ceiling.—The sides of the vessel ceiled with red pine, 2 inches thick, from the stem to about 10 feet abaft of well head, nailed to timbers, and further fixed to them by one half of the treenails passing through the ceiling planks. In the boiler space the ceiling sheathed with yellow pine, $\frac{3}{4}$ inch thick, and not more than 6 inches broad, nailed vertically to ceiling planks, and the 'thwartship carlins above the boiler lined in the same manner; but the ceiling of the coal bunker saved with larch $1\frac{1}{4}$ inch thick. The floors covered with red pine 2 inches thick, extending from fore end of boiler to stern, in boards not more than 8 inches broad, nailed to floors, and saved in the coal bunkers with larch $1\frac{1}{4}$ inch thick. The ceilings and flooring in good lengths, butt jointed on timbers, with a 6 feet shift and one strake between, and the floorings made to unship at the limber passages, and bilge keelsons, and where required for the machinery.

Stoking Floor.—The floors before the boiler covered with cast iron plates $\frac{1}{2}$ inch thick, close jointed, chequered on top surface, and with key holes to lift them out by.

Coal Bunkers.—A coal bunker formed on each side of the boiler, with red pine planks $2\frac{1}{4}$ inches thick, and about 10 inches broad, set on edge, and fixed with 2 hooked screw bolts to each plank, against 8 malleable iron pillars 2 inches square, securely bolted at both ends.

Waterways.—The waterways of red pine, 10 inches broad, $4\frac{3}{4}$ inches thick at the heel, and hollowed to thickness of deck plank, for water runs to scuppers, of which there are four in each side. It is in long lengths and continued round the bow, clinch bolted to every deck beam and every fourth timber.

Covering Board.—The covering board of British oak, from stem to luff of bow, and aft of that red pine, 11 inches broad and $2\frac{1}{2}$ inches thick, moulded on the outside, and fastened to waterways with 5 inch spikes 15 inches apart, and to timber heads and stanchions with clinched bolts. And saved on the outside with plate iron in good lengths and $\frac{3}{16}$ of an inch thick, bent to fit the curve, and fixed every 8 inches with counter-sunk rag bolts 4 inches long with flush heads and reeled, the joints butting close and with two bolts to each end.

Deck Planking.—The deck planking composed of the best Quebec yellow pine in long lengths, $2\frac{1}{2}$ inches thick, and not more than 6 inches broad, and fixed to beams with 5 inch spikes punched down $\frac{3}{4}$ inch, and the hole filled with a $\frac{3}{4}$ inch plug, put in with white lead; all the joints dressed and square, and with a bevel $\frac{3}{4}$ of an inch deep, and $\frac{1}{16}$ inch broad at each plank, each of which bears hard below the level on the adjacent ones, and is sufficiently caulked with four small threads of oakum, the first being white, and the three upper ones brown oakum of the best quality, fresh, and well-teased, and payed with hot pitch; the decks finally dressed flush, receiving two coats of bright varnish. The two deck planks on which the bow crab rests are of British oak, 12 inches broad and $3\frac{1}{2}$ inches thick, and extending in one length each from engine-house to bow, and fixed down with screw bolts, and the ends of the planks next the steam chest screwed on a piece of angle-iron bolted to beams. The two deck planks next the well sides of British oak, each 9 inches broad and $3\frac{1}{2}$ inches thick, and bolted together horizontally with $\frac{1}{2}$ inch clinched bolts.

Rail.—The rail composed of British oak stanchions 6 feet long, sided 5 inches and moulded $3\frac{1}{2}$ inches, securely fixed below to timbers and planking, placed 6 feet apart centres, chamfered on the edges and tenoned on the top end for a rail of American rock elm, $6\frac{1}{2}$ inches broad and $2\frac{1}{2}$ inches thick, rounded on the top and beaded on the lower edges.

Companions, &c.—Two framed companions fitted up with sliding covers and doors with brass locks and hinges, and hardwood traps with hand-rails fixed between deck and floor, and made to shift easily when wanted. The stoke-room hatch with a red pine cover fastened with a hasp and brass padlock. A ladder fitted between deck and stoke-room floor, to be made from malleable iron. The coal hatches covered with cast-iron plates 21 inches diameter, pierced with holes for air, and having chains and hooks, so that they may be fastened below.

Pillars.—The deck beams in engine and boiler space supported on three cast-iron pillars 6 inches diameter, and the roof of the engine-room carried by a malleable turned post $2\frac{1}{4}$ inches diameter.

Dead Lights.—Twelve dead lights in brass frames 12 inches × 6 inches fixed on deck.

Timber Heads, &c.—British oak stanchions, 5 feet long, securely fixed below, and cased on the top with double cast-iron caps with kevels, eight in number, besides two single ones at stern and bow; sheave chocks, with pulleys, fixed at knightshead and stern, for guiding the side springs, and two hawse pipes well tapered, firmly fixed into knightshead, and two cast-iron guides fixed in a British oak plank 12 × 8 bolted to stern, to save which, and the ends of the deck planking, plate-iron $\frac{3}{8}$ inch thick, and covering 6 inches on deck and stern, bolted on.

Stern Hawse.—The stern chain passing through an elliptical tube, in three pieces, the bottom part having an opening 4 inches diameter, the upper flange being 3 inches thick and the lower one 2 inches at the bend; the middle portion jointed on the lower one, and having flanges for screwing them hard together with felt between, and a faucit joint above, and supported by 2 pieces of oak, crossing the vessel and bolted together, the pipe elliptically shaped, and not less than 1 inch thick, and the upper portion with a flange for bolting down to deck, and a spigot end made tight into the faucit with an india-rubber ring.

Fenders.—A loose fender 5 feet long, 6 inches broad, and 4 inches thick, suspended from each of the rail stanchions, and the stern fitted with fenders 12 inches broad and 3 inches thick, bolted on, all of American rock elm.

Engine House.—The engine house of bound framing fixed in sockets attached to coamings; lined on the outside with boards 4 inches broad and 1 inch thick, and on the inside, including the roof, with $\frac{5}{8}$ inch lining. The roof covered with strong canvas painted with six coats of the best white lead, and a small cornice fitted up outside and inside; a bound door with brass lock, fitted with rollers to slide in grooves at top and bottom. Five windows, $2\frac{1}{2}$ feet by 2 feet, fitted with mahogany sashes to slide in grooves, and protected on the outside by brass guards. All the timber of yellow pine, and the four vertical angles rounded to a 3 inch radius, and protected with plate-iron screwed on flush.

Cabin Fittings.—A sparred partition with door, fitted up abaft of the hoisting barrel, to divide the engine space from the larboard hold, and the starboard side fitted for the crew living in, and the forward portion of it divided by two partitions with doors, and fitted with two berths, a table, two chairs, two presses, and two desks for the master and engineer; and the after portion with six berths, as many locked cupboards fitted against the partition, two tables, four forms, and a cabin stove, and shelving; the berths with iron bottoms, hinges, and chains, to fold up.

Quality of Materials, &c.—No by-wood allowed in any part of the work. All the knees natural crooks. All the outside planking sufficiently caulked, as already described for deck planking. The clinched ends of bolts, or nuts of screw bolts, bear on washers of a proper size. The timber sawn all round, and dressed in the side holds and engine-room. All the timber of the best quality, well seasoned, and no sapwood, shakes, dead knots, or other imperfections be allowed in any part of the work. The whole of the outside work, from the upper edge of the wales downward, receives two coats of the best Archangel tar; the bright strakes receiving two coats of bright varnish, and all the rest, except in the boiler space and forward of it, four coats of the best oil paint, the first coat of the iron work being red lead, and white lead for the wood work. A water-closet fitted into the vessel at the after end, and the pipe to lead into the well, and be made water-tight. Where the machinery, &c., passes through the deck, care is taken to box it in in such a manner that the water, in washing the decks, shall not run below.

Stores.—The boats of the best description, built full at the stern for lifting the anchors, and provided with a davit to each. The stern and stern-posts of British oak, as well as the timbers, which are natural crooks; the keels of American rock elm, planking of larch, except the wales, upper strake, and gunwale, all of American oak; three bound beams each, and protected with coping iron on the wales. The punt boat 16 feet 6 inches long over all, and 2 feet 6 inches deep, by a breadth of 5 feet at the waist, and 4 feet 3 inches at the stern. And the machine boat 19 feet 3 inches long over all, and 3 feet deep, by a breadth of 6 feet 9 inches at the waist, and 5 feet 2 inches at the stern. The following stores also provided, of the best quality, namely—two single fluked working anchors, weighing 7 cwt. each, having the flukes longer and the palms broader than usual; also, two kedge anchors, weighing 2 cwt. each, and two of the same, but weighing $2\frac{3}{4}$ cwt. each. Two hundred and forty fathoms of the best $\frac{3}{4}$ inch short link chain, made from Govan B B iron, and proved to $7\frac{1}{4}$ tons, in eight lengths joined with shackles.

The following quantities of ropes, made from the best St. Petersburgh hemp, and tarred, namely—

Four coils,	each containing 40 fathoms of			$3\frac{1}{2}$	inch rope.
Two	do.	do.	do.	3	do.
One	do.	do.	do.	2	do.

The undernoted iron blocks, made as short as possible, namely—two pair of 3s and 4s capable of carrying 8 tons each, one pair of 2s and 3s capable of carrying 2 tons, and a pair of wooden 2s and 3s strapped with iron and capable of carrying 1 ton, for boat tackle. Two poles shod and hooped, each 30 feet long; two sounding rods, each 25 feet; and two ditto, same length but with prickers; one pole 20 feet long, with barb; four boat hooks 15 feet long; and 8 ash oars. Four chains, each 15 feet long, for attaching punt to stern while being filled; two 12 gallon water barrels, with stands and handspokes; a small cooking apparatus and stand; a dresser with drawers in cabin; a 12 feet ladder, and a short side one; two brass lamps in gimbals, to be fitted in the engine-room, and two in the cabin; and in the engine-house a mat and wax-cloth, 6 tin cans for tallow, oil, &c.; a complete set of screw keys, marked and fitted in a rack; 4 hammers, 12 files, 12 chisels, a saw, an adze, a hatchet, a grindstone and stand, a 6 inch vice, hand mallet, and stob mall, a force brace and 3 drills. Also a brass globe lantern and a signal bell, weighing 1 cwt.

MECHANIC'S LIBRARY.

Agricultural Engineering. 12mo, 1s. cloth. G. H. Andrews.
Artistic Anatomy of the Human Figure, 12mo, 1s. H. Warren.
Artists and Great Anatomists, Great, post 8vo, 6s. 6d. cloth. Dr. Knox.
Bookbinder's Manual, seventh edition, 12mo, 2s. 6d. cloth. Cowie.
Bridges, Works on, fifth edition, 31s. 6d. G. D. Dempsey.
Celestial Scenery, new edition, 12mo, 5s. 6d. cloth. Dr. Dick.
Chemical Manipulation and Analysis, new edition, 8vo, 10s. 6d. Noad.
Civil Engineering, sixth edition, royal 8vo, 16s. cloth. D. H. Mahan.
Collieries, Winning and Working of, second edition, 12s. 6d. cloth. M. Dunn.
Differential Calculus, Treatise on, 8vo, 8s. 6d. cloth. T. Miller, M.A.
Differential Calculus, 12mo, 1s. Woolhouse.
Embanking Lands from the Sea, 12mo, 2s. Wiggins.
Euclid, Figures of, fifth edition, foolscap 8vo, 2s. cloth. J. Edwards, M.A.
Exhibition, Lectures on the Results of the Great, crown 8vo, 7s. 6d. cloth.
Integral Calculus, 12mo, 1s. cloth, sewed. Cox.
Long-line, Flax-cotton, &c., Preparation of, 5s. cloth. Dr. Ryan.
Metallurgy, Manual of, "Encyc. Met., vol. xxi.," post 8vo, 12s. 6d. cloth. Philips.
Natural Philosophy, Lectures on, 2 vols., 8vo, 10s. cloth. M'Gauley.
Perspective, Theory and Practice of, 8vo, 5s. cloth, sewed. W. Locock.
Plane and Spherical Trigonometry, third edition, 7s. 6d. H. W. Jeans.
Rudimentary Astronomy, 12mo, 1s. cloth. Rev. R. Main.
Steamer, The Lost. A History of the Amazon, foolscap 8vo, 3s. 6d. cloth.

RECENT PATENTS.

MANUFACTURE OF LEATHER.

JULIAN BERNARD, *London.—Enrolled May 13th,* 1852.

Under his "improvements in the manufacture of leather or dressed skins, and of materials to be used in lieu thereof, and in the machinery or apparatus to be employed in such manufacture," Mr. Bernard describes five several heads of invention.

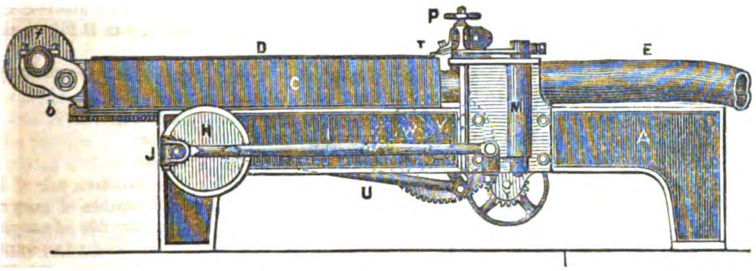
1. A mode of graining or ornamenting leather, relating more especially to the preparation of imitation morocco leather. In this process a good original morocco skin is selected, and an electrotype plate taken from it, as a matrix or die. This plate, presenting an exact counterpart of the skin, is then laid upon a steam-heated chamber on the table of a hydrostatic press, the skin to be grained being laid upon it, and over the skin a sheet of vulcanized india-rubber. This triple layer is then subjected to

pressure in the usual manner, and the electrotype matrix then impresses its figure on the leather surface—the india-rubber allowing for any irregularities in the thickness of the leather, and assisting to force the latter into the minute interstices of the die. Instead of obtaining the die by the electrotype, the requisite figure may be produced by engraving a metal plate, but the electrotype system affords a ready means of obtaining a perfect fac-simile of a good figure.

2. A machine for shaving or splitting leather, wherein atmospheric pressure is employed for holding down the skin, whilst a peculiar action is given to the knife, enabling the operator to shave leather into inconceivably thin and regular skins.

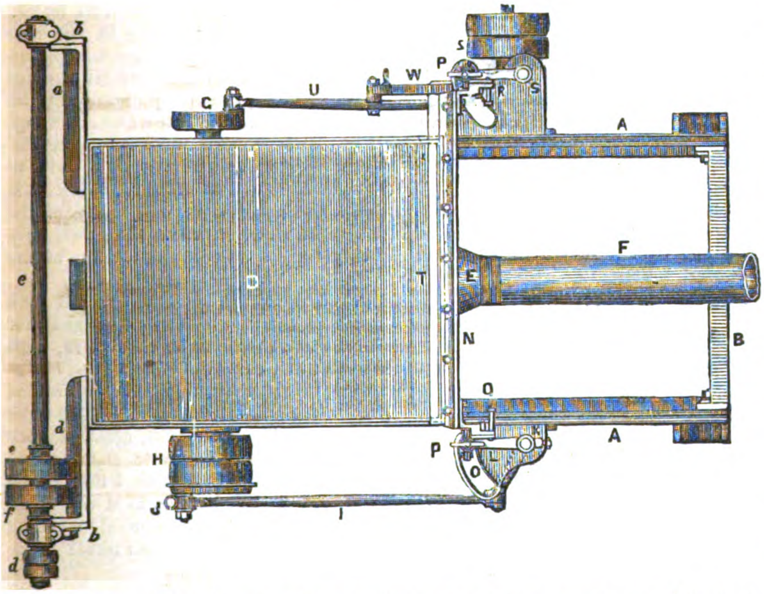
Fig. 1 of our engravings represents a side elevation of the shaving or splitting machine; and fig. 2 is a corresponding plan. The framing is

Fig. 1



composed of the two longitudinal standards, A, and two transverse standards, B, bolted together at the angle junctions by inside lugs. The upper edges of the longitudinal frames are formed with V-grooves, to correspond to V-slide projections, set parallel to each other on the two opposite bottom edges of a metal-box, C, which is thus enabled to traverse at pleasure in an accurate horizontal plane, from one end of the frame to the other. The box is cast with a solid bottom, on the inside upper surface of which are a series of ribs or narrow projections, on

Fig. 2.



which a slab or table of porous stone or other permeable composition, D, is laid, so as to leave an air-space beneath. The porous slab fits to the inner sides of the box, and the junctions therewith are made air-tight by slightly recessing the upper edges of both the box and slab, this recess being filled up by a strip of elastic material or plaster, to cover the junctions. At one end of the box, C, and beneath the level of the bottom of the permeable surface, D, is an opening, E, in communication with a distended flexible pipe or air-duct, F, one end of which is fastened to an expanding flattened mouth-piece, surrounding the opening, E, the other end of the flexible duct being led away to a double-acting air-pump, or other exhausting apparatus. By this means the air-space in the box, D, is capable of being exhausted through the duct, F, even whilst the box is traversing along its slides; and the surface, D, being slightly permeable, it follows, that whatever is laid upon it during the exhausting action, is pressed down uniformly in every part by the weight of the external atmosphere, and it is this pressure which affords the means of firmly holding down the leather during the shaving action.

The cutting action of the knife, and the traversing action of the porous table, are obtained from the main horizontal driving-shaft, G, carried in bearings in the side standards, beneath the level of the box, and having at one end fast and loose driving-pulleys, H, for a belt from the prime mover, and at the other a slotted crank disc for the traversing action during the cutting operation. The outside fast pulley, H, has attached to its face a short stud, for giving motion to the connecting-rod, I, for the knife-action, the stud having jointed upon it a short block-piece, fitted within the forked end of the rod, I, and connected by a second joint-stud, J, with the double eye of the rod, so as to form a second joint at right angles to the stud. This connection admits of the free traverse vibration, or duplex motion, of the rod, I, as the stud, J, revolves, the contrary end of the rod, I, being jointed by a similar duplex connection with a bell-crank, turning on a fixed stud centre at K. This bell-crank is formed of the two short levers, L, respectively attached to the top and bottom of the short vertical shaft, M, working in a bracket bearing on the side of the frame. The upper lever, L, is jointed to an angular bracket of the knife-holder, N, the upper side of the bracket for the bell-crank being extended to form a segmental face-piece, O, for the projecting face of the lever eye to bear upon during its traverse. The socket-piece by which the connection is formed between the lever and the bracket, contains an adjusting screw, with an upper cross-piece, P, for turning it by hand to raise or lower the knife; and it has also a side-piece, by which it is jointed by a stud to the bracket, a steady pin, Q, being passed through the two pieces, to hold them in position when cutting. The other end of the bracket is bolted to one end of the knife-holder, the opposite end being similarly bolted to a corresponding bracket connected to the free end of a lever, R, precisely similar to the lever, L, and turning on the fixed centre, S, in a bracket on the side-frame. The knife-holder is formed of a piece of angle-iron, underneath the horizontal flange of which is placed a flat plate, the steel knife, T, being set between the two surfaces, and bolted up by vertical bolts. The skin to be split is laid flat out upon the stone surface, and the knife is then adjusted at the proper level to take off the required thickness. The exhausting apparatus is then set in motion to form a partial vacuum beneath the porous table, so as to hold the skin in an accurate plane with great firmness. The revolution of the shaft, G, then causes the knife to oscillate or traverse rapidly back and forward across the machine, the cutting edge shaving off the upper side of the leather in one unbroken sheet, leaving the shaved skin of perfectly uniform thickness beneath. As the horizontal traversing cut is being made, the skin is kept up to the cutting edge by the traverse of the table, D, caused by the revolution of the stud adjustable in the slotted face of the disc on the driving-shaft. The connecting-rod from this stud, passes to a pin in the end of the arm of a bell-crank, turning on a centre at V, the upper horizontal arm, W, having attached to it a detent, working into the teeth of the spur-wheel, X, fast on a horizontal shaft carrying a toothed pinion, working into a rack on the under side of the box, C. In this way, at each traverse of the knife for a cut, the leather is carried up towards it a certain determined distance, until the whole skin has been split or shaved.

When this is accomplished, the action is stopped by throwing the driving-belt on to the loose pulley, H, of the driving-shaft, at the same time disengaging the catch from its wheel, X, and setting the reversing shaft, Y, in motion, to carry back the table. The belt actuating this shaft is thrown off the loose pulley upon the fast one, Z, thus causing the pinion which is fast upon the shaft, Y, to revolve and drive the spur-wheel in the reverse direction, and carry back the table in readiness for receiving a fresh skin. It is obvious that various arrangements may be adopted for working the table in each direction—such, for example, as modifications of the self-acting motions used for traversing the tables of planing machines. Considerable economy arises from the use of this machine in place of the ordinary manual or other process, as well in time, as in the fact, that the back or flesh side of the leather is shaved off from the face whole and entire, so that what has hitherto been treated as refuse may now be applied to various useful purposes. The cut of the knife is also much improved, the severed surfaces being quite smooth and even, so as to obviate the necessity of any subsequent

hand-shaving, at present required to remove the ridges left by the common splitting machine. Instead of the flat knife, a revolving spiral knife may be adopted in its place, the main object of the invention being the secure holding down of the leather. In cases where a great number of skins, pretty nearly equal in size, are to be operated upon in the machine, the practical difficulty arising from the irregular areas of the skins laying bare portions of the permeable surface, and thus injuring the vacuum, may be obviated by providing pieces of an impermeable fabric, cut out nearly to the contours so bared, which may thus be covered up. And in shaving the uppers of boots, where there is little variation in the size of the pieces, the same system may be adopted, the entire table being covered over with an air-proof material, leaving only a hole in such material to admit the upper. Instead of using a porous table on which to hold down the skin to be split or shaved, the porous or permeable material may be formed into a cylinder, over which the leather may be passed during the cutting action.

To prevent any difficulty in the action of the knife upon the irregular edges of the leather, the table, or other supporting surface, over which the cut is made, may be arranged so as to be capable of turning round; or the knife may be reversed, so as to cut from the centre towards the edges. If the layer of skin should interfere with the knife-action as it is shaved off, the severed end must be attached to an overhead cord, passed over a pulley, and having a weight hung to it. By this means, the severed layer will be carried up out of the way of the knife. In order to provide for the periodical grinding and sharpening of the splitting-knife, an apparatus for this purpose is fitted to one end of the traversing-box of the table. Two brackets, *a*, *a*, are bolted to the opposite corners of the box, and to the outer ends of these brackets are attached two bearing brackets, *b*, *b*, being held up at any required angle by the stiff friction resulting from the tight screwing up of the bolts which fix them to the brackets, *d*, *d*. The brackets, *b*, have each a journal to carry the horizontal grinding-shaft, *c*, fitted with fast and loose band-pulleys, *d*, as well as with a grindstone and buff-wheel or pulley, *e*, *f*, which are fitted on the shaft with a fixed feather, so that, whilst they revolve with the shaft, they may traverse, at the same time, longitudinally. When the knife is to be ground and sharpened, the grinding-shaft is traversed up to the knife. The holder of the latter being slackened, the steady pins are removed, and the holder may then be turned, to bring up the knife to the required angle with the revolving-stone and wheel, *e*, *f*, which are made to revolve for the grinding and sharpening action. As the grindstone wears, it may be set up at any angle required, to bring its periphery into contact with the knife, by setting up the brackets, *x*, upon the bolts, *y*. The improved arrangement for turning the knife over the grindstone, as well as the grinding and sharpening apparatus, may be adapted to ordinary splitting machines.

3. A material, termed "Compound Union Leather."—This very valuable fabric is composed of a layer of leather, cemented or joined to any woven or felted fabric; so that, by the assistance of the patentee's shaving machine, what has hitherto been considered as little better than mere refuse, may be worked up into stout sheets having the external appearance of leather. Where still greater strength is required, a strong woven fabric may be inserted between two layers of skin. Such fabrics can be produced economically only in conjunction with Mr. Bernard's shaving machine, which affords the means of obtaining extremely thin sheets, with smooth surfaces, ready for use at once. The production of such fabrics is to be regarded as a most important branch of the economics of the leather manufacture.

4. A compound fabric of great strength, by joining together two separate woven fabrics, with their warps at right angles to each other; or the same end may be arrived at by joining together two fabrics with their warps parallel to each other, but specially prepared for the purpose, by weaving one with a stout warp and weaker weft, and the other under the reverse conditions. In either case, a strong fabric is produced, having the same tensional strength in all directions.

5. A mode of diceing, or ornamenting the surface of leather, by a species of diamond lines, either by rows of fixed markers acting on a skin placed beneath them; or by a series of circular disc markers, between which, and a counter-pressure cylinder, the skin is passed.

The whole of Mr. Bernard's improvements—but especially the first, second, and third heads—are valuable accessions to the leather manufacture.

WEAVING FIGURED FABRICS.

T. Crook *and* J. Mason, *Preston.—Enrolled May* 19, 1852.

This invention, which opens up a totally new system of weaving what the manufacturer calls "cord-checks" and "tape-checks," and other figured goods, relates to an arrangement whereby any number of "picks" may be thrown in a shed for checked fabrics—the arresting the progress of the warp at required intervals, for obtaining a firm "beat-up"—various plans for raising and lowering the "catch-cords" at each pick—the locking the reed (when a loose one is used) at the moment of beating up—the self-acting stoppage of the loom for a change of shuttles—a novel mode of raising and lowering the drop-box—and the preparation or varnishing of certain portions of the healds.

The weaving of checked fabrics, by making a number of picks in one shed, is effected by the use of endless chains having projections upon them, and passing over notched or grooved pulleys, the projections being made to act upon the levers working the healds. These chains are ranged vertically, side by side, outside the end framing of the loom, the notched pulleys or disc wheels being on a shaft near the floor. The chains are passed over these pulleys, and are again supported by small overhead carrying pulleys. When several picks are required in one shed, the projection at that portion of the chain working the heald, is made longer than its near neighbours, thus keeping the lever and its heald depressed during its passage. A separate chain and pulley is employed for each heald; and, in plain weaving, the small projections on each chain act upon the two levers alternately. Another chain is employed for arresting the progress of the warp when a check occurs: the projections, as they come round at the required times, depress a lever, which action elevates the detent of the ratchet-wheel of the taking-up motion.

Instead of endless chains for these various movements, suitable wheels, with pins or projections acting as cams, may be employed, in order to simplify and add to the compactness of the loom. Thus, when the detent is raised out of gear with the ratchet-teeth, the tension of the warp and partially woven piece causes the cloth beam to return back to its original position, after each stroke of the slay sword, there being no catch to retain it. In this way, although the taking-up motion is still a constant worker, its effects are thus simply nullified, and the corded line across the piece, as required by the pattern, is produced by merely beating up a number of weft threads into one shed. The return of the thread, when more than one is thrown into a shed, is prevented by catch-cords along the selvages, worked either by another chain-wheel, or by one or more cams, all the movement that is necessary being simply a reciprocating motion like that of the healds, so that a single cam and a reacting spring afford all that is required. In loose reed looms, a difficulty arises from the liability of the reed to give way in the hard beat-up of several picks. To remedy this, a vertical sliding-bar is placed on the inner side of the slay sword, and on this bar is a small bearing pulley. As the slay advances to the beat-up, the pulley mounts up the inclined end of a fixed bar, projecting from the front of the loom framing, and the vertical bar is thus carried up in its slides, until its upper end comes up behind the bottom edge of the reed, just as the latter is about to strike up the last weft thread. On the return of the slay, the reed is again released, so that no danger is incurred in the early part of the stroke, from the chance of hitting a detained shuttle. The patentees give various arrangements for obtaining a differential motion of the healds.

The stoppage of the loom for the change of shuttles is effected by a pin-wheel, actuated from the slay sword, the pins being so arranged that their intervals allow the required number of picks to be thrown in, until the succeeding pin acts on the stop-rod, and stops the loom.

In weaving small coloured patterns, this frequent stoppage is avoided by the use of a "drop-box," similarly worked from a pin-wheel—the drop-box having in it any required number of shuttles, arranged one above the other.

The last head relates to the so varnishing the healds, that the bottom shank and ring only are treated with the preparation, the knot and upper shank being left unvarnished. By this means the objectionable working of the hard varnished knot is obviated, and the yarn is less liable to injury from its action.

REGISTERED DESIGNS.

APPARATUS FOR MOULDING AND ATTACHING SHOE SOLES.

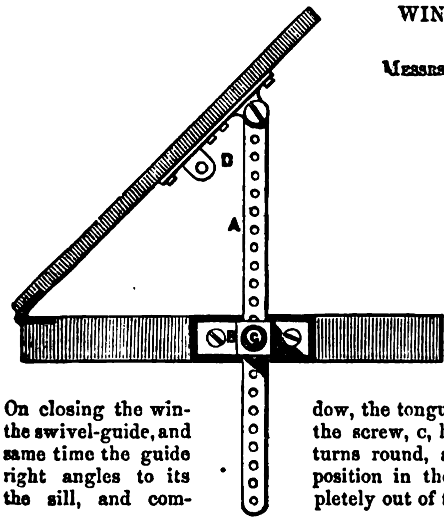
Registered for Mr. Wm. M'Lennan, *Brassfounder, London Street, Glasgow.*

The object of Mr. M'Lennan's invention is the formation and attaching of gutta percha, or other soles, to boots and shoes—a contrivance likely to come into very extensive use, now that gutta percha, with its kindred gums, are proved to be so commercially valuable. It is simply a metal frame in two halves jointed together, which, when closed and fastened, form a skeleton mould or shaper of the external contour of a shoe sole. In putting on a gutta percha sole, the upper leather of the shoe, as fitted

on its last, is reversed, and placed in the space enclosed by the mould from below, the bottom of the last being pressed hard up against an inner flange in the mould by a couple of screws. The gutta percha is then pressed, in a soft state, into a space left in the depth of the mould, above the inner flange, this space being equal to the depth or thickness of the intended sole. The proper form for the sole or treading surface is then given to the soft material, by laying upon it a cover-piece duly shaped for that purpose, pressing it down by screws from above. This moulds the material to the required sole shape, and causes it to adhere firmly to the upper leather. Leather or other soles may also be attached by this apparatus, the junction surfaces being first treated with an adhesive solution to cause adhesion. After trimming off the superfluous material, the shoe is released by opening the mould, and the operation is complete.

WINDOW FASTENING.

Registered for MESSRS. WEBB *and* GREENWAY, *Birmingham.*

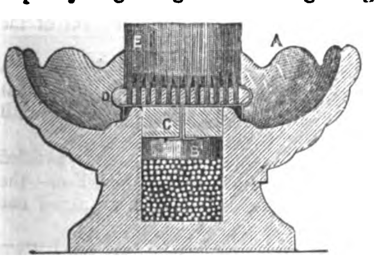


This contrivance is intended for securing lattice or French windows, as well when shut as when open, to any required extent. The rod, A, travelling in the swivel-guide, B, and fixed at any point by the screw, C, enables the window to be secured with any amount of opening. On closing the window, the tongue, D, falls into a slot in the swivel-guide, and the screw, C, holds it there. At the same time the guide turns round, and the rod, A, lies at right angles to its position in the figure, namely, along the sill, and completely out of the way.

COMBINED PEN CLEANER AND STOPPER.

Registered for MESSRS. A. MARION & Co., *Fancy Stationers, Regent Street, London.*

This very pretty design is at once an ornamental and a useful appendage to the writing-table. Its stiff brush affords a ready and efficient means of clearing off the thick accumulations which so constantly annoy the writer, whilst the external surrounding vase answers as a cup for holding small loose articles of the desk, and, at the same time, presents a purely elegant figure. Our engraving is a vertical section of the contrivance, and, consequently, shows only its *useful* properties, as the twisted exterior cannot be seen in it. The vase, A, which may be variously contrived, is formed in this example with a central recess, B, to be filled with shot and water, as a further cleanser, the opening being covered in by a cork or other stopper, C, covered by a metal ferrule, D, and studded at the top with stiff bristles, E, fixed in a disc of hard wood as a holder.



Although we have shown the brush as fitted to a vase, Messrs. Marion also propose its use detached, so as to lie on the table alone, or to fit it as a stopper for a common bottle inkstand, in which position it will be always ready for use when the ink is to be shut up and the pen dried out. But the vase arrangement, of which we have specimens before us in blue, white, and other colours of opaque glass, may adorn the drawing-room.

IMPROVED HEATING BOILER.

Registered for MESSRS. E. COCKEY & SONS, *Ironfounders, Frome, Somerset.*

Messrs. Cockey's design relates to an extension of the available heating surface of boilers, without any loss from unwieldiness. Such boilers, as our illustrative examples explain, are suitable as well for domestic purposes as for conservatories, hot-houses, or public buildings.

Fig. 1 is a transverse vertical section of the boiler, as fitted up in its seat complete; and fig. 2 is a corresponding longitudinal section at right angles to fig. 1. A, is the brickwork seating of the boiler, the transverse section of which is that of a species of ellipse. It consists of an external shell, B, through which is passed the flattened flue, C, open at each end, where it is attached to the outer shell by suitable collars or flanges, D, E. The boiler rests upon the brickwork by flanges, F, F; immediately beneath which flanges the sides descend almost vertically, and finally terminate in a corrugated or undulating bottom, G, presenting a large heating area to the direct radiation from the grate, H. The horizontal steam-pipe, I, J, opening into the corrugated bottom, passes right and left transversely beneath the boiler, for the return of the cooled water after circulation; whilst the vertical pipe, K, opening into the top of the boiler, conducts heated water to the corresponding steam-pipe, L, M. The sides of the furnace slope outwards at N, to the full width of the boiler, and the whole is covered in by a brick arch, O, forming the outer flue. The arrows indicate the direction of the flue current. After leaving the furnace, the current passes up into the flue, P, and enters the after end of the internal flue, C, through which it passes to the front, and emerges into the outer flue, Q, and finally enters the chimney, R. The effect of this arrangement is, that the corrugated bottom, in combination with the internal flue, C, and outer arched flue, Q, presents a most effective heating surface for the water.

Fig. 1.

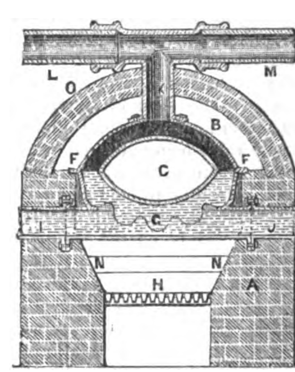
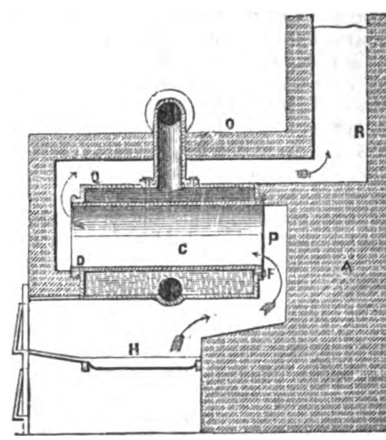


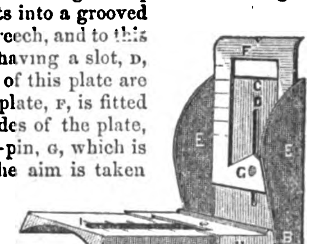
Fig. 2.



ELEVATION SIGHT FOR BALL SHOOTING.

Registered for HENRY MALING, ESQ., *Home Office, London.*

We have already described and illustrated an ingenious "sight" of Mr. Maling's,* and we now give a second one by the same inventor, and slightly different to his original plan. Our figure represents the sight in perspective. The base plate, A, fits into a grooved or slotted bed on the top of the gun's breech, and to this plate is hinged at B the thin plate C, having a slot, D, formed through its centre. The sides of this plate are turned over, as at E, and a thin metal plate, F, is fitted to move vertically between the two sides of the plate, to which it is connected by the rivet-pin, G, which is capable of sliding up the slot, D. The aim is taken through the angular notch on the upper edge of the sliding-plate, F.



When out of use, the entire apparatus folds down on the surface of the plate, A, leaving the turned-up notched portion projecting above the band; and when required for use, the sight is elevated by simply pushing forward the small slide, H, in the horizontal groove, I, in the centre of the base plate, which is graduated for the purpose. When a sufficient elevation for a very long range cannot be obtained by this means, the sliding-plate, F, is then raised, as shown in our engraving—one side being graduated for that purpose—whilst the top of the corresponding edge, E, serves as an indicator of the amount of elevation.

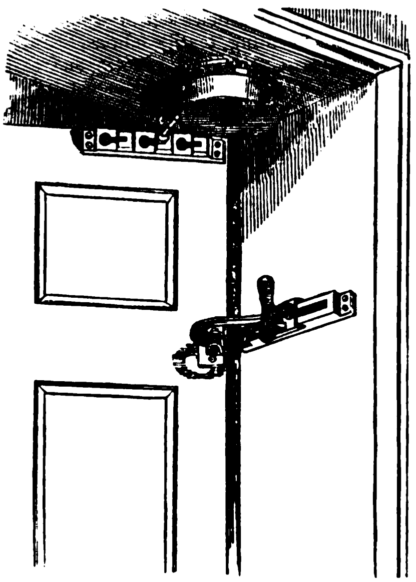
* Page 11, ante.

BOX DOOR-SPRING, AND STAY-FASTENER FOR DOORS AND WINDOWS.

Registered for Mr. J. Kimberley, *Inge Street, Birmingham.*

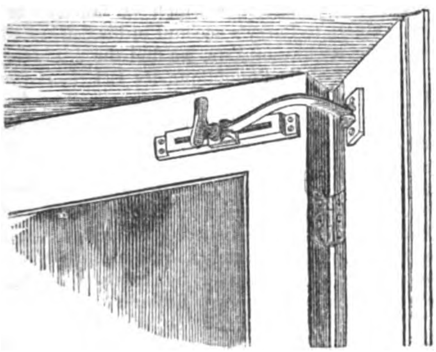
The door-spring is represented in fig. 1, as applied to the top of a door.

Fig. 1.



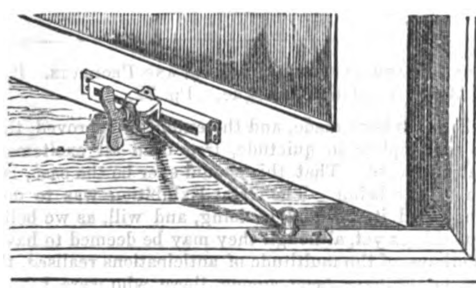
It consists of a spring, similar to a watch or smoke-jack spring, in a small round box, with a jointed chain attached, which the spring coils up, thereby pulling to the door. The chain has a button at the end, and a brass plate is fixed to the door, having several button-holes, the spring acting with greater or less force, according to the distance of the ball in which the button is fixed. The spring can also be either tightened up or slackened, so that it can be regulated to doors of any weight or thickness. It will suit doors either right or left, or in any situation, and is completely out of the way, being fixed at top or bottom of the door, inside the door-case; and the door can be released from it, and allowed to go free in one moment, simply by detaching the button from the plate fixed to the door.

Fig. 2.



The stay-fastener allows of doors or windows being opened, shifted, or fixed at any minute distance or angle. It is equally applicable to skylights, greenhouse, French casement, cottage, almshouse, and union-house windows, and also for ship cabin-doors. It is made with straight or bent arms; with the former, for windows with shutters, closing unusually near to the window frame, and with the latter, for any other description of door or window. The arm is fixed to the door or window frame by means of a jointed staple; the other end slides in a

Fig. 3.

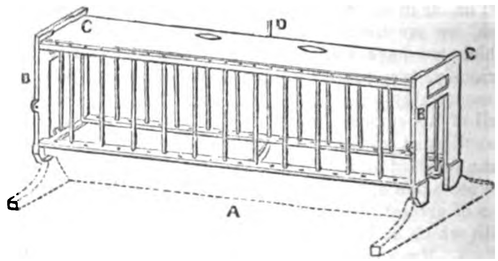


grooved piece of brass fixed to the door or window, and is secured at any point by a screw. The fastener, with a bent arm, is shown in fig. 1, applied to a door, and in fig. 2, applied to a window. Fig. 3 shows the fastener with a straight arm. These instruments are very simple and effective.

GUARD-FRAME PIG TROUGH.

Registered for Mr. John Keable, *Lambourn, Berks.*

The object of this design is to prevent the waste of food caused by pigs getting into the trough, and thrusting each other about—that is, to teach them cleanlier habits; also, to keep them away from the trough while being served.



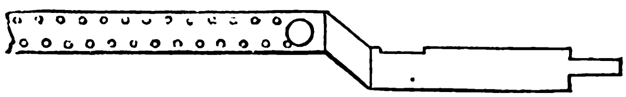
A, is an outline of the trough in dotted lines; B, B, the guard-frame, on each side of which are several bars adjustable at different intervals. On the further side the bars are fixed in a slight frame suspended by pins at C, C, which is opened inwards by means of the handle, D, when the food is being put in, and, coming against the nearer side, prevents the pigs from 'falling to' before the food is ready. The food may also be put in at the top, the cover being removeable.

CRANKED FALLER FOR SPIRAL GILLS.

Registered for Mr. John Whitehead, *Midland Junction Foundry, Leeds.*

This design, which is the invention of Mr. Whitehead, of the well-

Fig 1.



known flax machine-making firm of Taylor, Wordsworth, & Co., is intended as a means of getting nearer the "nip" of the drawing roller, to draw a short fibrous material more even, whilst the roller neck may be increased in diameter.

Fig. 2.

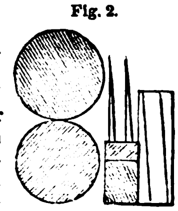
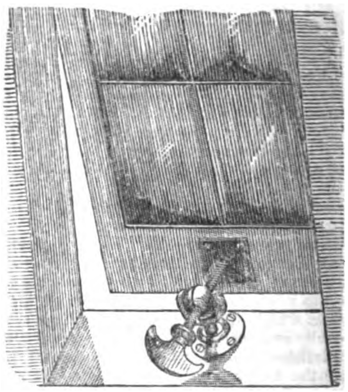


Fig. 1 is a plan of one end of the faller, and fig. 2 is an end elevation, showing its application to a pair of drawing rollers. The sketches afford their own explanation. It is clear that this simple modification of cranking, compasses the desired end. It is also applicable for approaching nearer to a comb or hackle for combing or straightening any fibrous materials.

SKYLIGHT STAY.

Registered for Mr. Griffiths, *Liverpool.*



This is a simple arrangement for adjusting skylights, so that they may be kept open to any required extent. A long screw, fixed at one end to the casement, but capable of being turned, passes through a ball-shaped nut, fixed to the frame of the skylight: this nut is set on pivots, to allow for the varying inclination of the screw, as the casement is more or less open.

REVIEWS OF NEW BOOKS.

On the Chemical Principles involved in the Manufactures of the Exhibition, as indicating the Necessity of Industrial Education. By Lyon Playfair, C.B., F.R.S. Bogue, London. 1852.

When a man deals with principles as but with facts of a more significant character, and is listened to with attention and approbation by minds of acknowledged superiority, what he says commands, rather than excites, consideration. If he treats of the interests of an empire, and all his

conclusions refer to them, he speaks with irresistible power to the most intelligent, in the thoughts of whom his words stand out as proverbs, and himself as a gifted preacher. Standing, however, on such high ground, he needs must participate in some inconveniences of his position. Amongst these is this, that often his language is not understood, or, which is much worse, misunderstood. He has grown imperceptibly to the stature of a giant, physically and mentally, and we who may have known him as a boy, cannot make up our minds to know, which nevertheless is too true, that he has outstripped us in the race of life, and left us far in the distance. Recalled thus to a sense of our true position, we are compelled to look about us, and to analyse the means by which we have lost our caste. This necessarily leads us to reflect seriously, very seriously, upon those other means by which others have demonstrably gained what we have lost. Professor Playfair deserves well of his country in speaking out as he has. It is not every one who investigates, and at length perceives, great truth, who dares boldly to come forward and announce it. He, whoever he may be, who urges on the reception of the truth by arguments of all kinds, shows the possession of greater power still. He knows and he feels that the convictions with which he is himself impressed, are capable of being impressed upon others. Even a world armed against him, operates but as an incentive to putting the matter before men's minds in every conceivable shape. His faith in the principles he has laboriously arrived at, stands as a steady light before him. He looks to it alone, and pursues, unflinchingly, his path—the only path such as he can follow; and the modern prophet walks among his fellows, regardless, but for their good, of worn-out conventionalities, and steadily perseveres in his teachings, being convinced that, although they may not, at once and immediately, profitably apply his sayings, those sayings must be listened to—must be recorded.

The strange thing is, that in this old age of the world, "the necessity of industrial education" should become a topic upon which the attention of a nation, eminent among all nations for its industrial character, should be aroused. In our pursuit of wealth, we have sacrificed everything to the practical. The position in which, by so doing, we have placed ourselves, originates the startling consciousness, that the wealth of which we are possessed is not, after all our strivings, the real thing to be aimed at. We have mistaken, in fact, wealth for power, and find, at past the eleventh hour, that money is a form only, and the lowest form too, of that more noble substance. Proteus, in the biography of the ancient and beautiful fable, was represented as difficult of access, and as refusing, when consulted by meaner gods, to give answers, by immediately assuming different shapes, and, if not properly secured in fetters, as eluding the grasp in the form of different animals, or disappearing in a flame of fire, a whirlwind, or a rushing stream. The god which we have *not* striven to attain is this same Proteus in his true nature; that for which we *have* striven, and which we *have* attained, is the wild, untameable, or debased creature which lies before us in our coffers, in shining gold. The author would enforce this truth, however disagreeable it may be; and, recalling first principles, it behoves us to listen carefully to what he says.

He commences with the following just observations on the great differences between nations, as characterised by the peculiarities of their industries:—

"The industrial products of the different countries represented at the Exhibition showed, as a marked feature of ascending civilization, that civilized states differ from barbarous nations in their manner of employing natural forces as aids to production. In the less advanced state, human labour, often exhibited with an endurance and patience scarcely conceivable to Europeans, attained good results, though not superior to those produced by European methods involving quick execution with little manual labour. I might refer you, as an example, to the fine blue glazed tobes worn by the higher class of Africans. This cloth, dyed with indigo, receives its gloss by the laborious process of rubbing, with the shell of a snail, as hard as the force of the wrist can bear. About fifty years since, our hand-loom weavers used a round bottle for a similar purpose, but now our calenderers give, in the same time, to miles of cloth, a gloss superior to that produced by this infinitely laborious process to a few inches of the material. It would appear that the less civilized nations attain a high degree of excellence in manufactures, when they depend on mere ingenuity and labour, as in the muslins of Dacca and Chunderee, and do not involve an intimate acquaintance with natural forces. So far as regards beauty of design, and the harmony of colours, European nations had little to teach, but much to learn. The rude pottery of Tunis was more elegant in form than the common pottery of modern Europe. The shawls and carpets of India, both as to design and harmony of colouring, were unequalled. So long as the manufactures involved human labour and a perception of beauty as their principal elements, the less civilized states equalled, and often excelled, the productions of Europe. But when economy of time and of labour, or an enlightened comprehension of a natural force, became essential conditions, then the striking progress of European manufactures was manifested. * * * *

"The position of nations in the scale of civilization depends upon their greater or less acquaintance with, and employment of, natural forces. All nations have a conception of their use, but their relative success arises from their applying them to the best advantage, and under the most favourable circumstances."

Having premised thus much, Mr. Playfair proceeds to his more immediate subject. He divides the various applications of chemical science to manufactures, into three heads:—1. Chemical appliances which have added to human power, either by furnishing substitutes for mechanical contrivances, or by affording tools and methods of arriving at results formerly impossible. 2. Methods of producing economy of time, generally resulting from a constant tendency to simplification. 3. Methods of utilizing products apparently worthless, or of endowing bodies with properties which render them of increased value to industry. Our space does not permit us to dwell upon the various articles separately noticed. These are, in order, as follows: Iron smelting, textile fabrics, leather, mineral and metallic manufactures, soap, perfumery, candles, and coal gas. This enumeration must suffice for our present purpose, compelled as we are to hasten on to the rousing truths he tells us, with forcible plainness, of our great defects, particularly in the means of educating youth to the appreciation and aim after the beautiful. After comparing, to our disadvantage in *most* things, the continental products at the Great Exhibition with our own, he advances the proposition, that "a competition in industry must, in an advanced stage of civilization, be a competition of intellect." The moment the terms of this are understood, that moment must the proposition be considered and acted upon as a maxim or incontrovertible axiom. Then comes the question, "If so, how do we stand?" This is at once answered by the professor, by asserting, what every one whose opinion may be valued knows to be true, that our system of education is "utterly unsuited to the wants of the age." He complains, following in this Sidney Smith in his memorable review article, of there being "too much Greek and Latin"—that education is too classical. But let him explain himself. "Now, while I urge the impolicy of a mere classical education to the youth of this country, with all the expression which I can give to a matured conviction, do not suppose that I would wish to put all our youth in one Procrustean bèd. I again allege, that it is the present system which follows this singular love of uniformity, and clips or extends the dimensions of each youth to one common standard." "In this country we are, in many respects, remarkably unchangeable. Three professions—the church, the law, and medicine, were supposed some centuries since to represent learning, and, with a wonderful blindness, they are still accepted as all-sufficient."

To these strictures we would add, as a singular fact, that we ourselves originated that teaching and public stimulus which has resulted in our own defeat by many nations, in many matters in which we fancied ourselves beyond any reach. In a note to Barry's account of his celebrated pictures in the Great Room of the Society of Arts, we find the following passage, quoted from the "Nouvelle de la Republique des Lettres et des Arts." Paris, le premier Juillet, 1781. "L'exemple donné par l'Angleterre a déjà été imité dans d'autres pays. Tout le monde connait ici l'institution de la Société d'Emulation, que l'on travaille, dit on, à relever aujourdhui. La Republic de Genève en a adoptè une semblable; il existe à Madrid, sous le titre de Los Amigos del Pays (les amis du Pays) depuis trois ans." This was written by a Frenchman in reference to, and after the Society of Arts had been long established. It now becomes a national question, whether we are pusillanimously to rest inactive when we see our own suggestion adopted and carried out by strangers in such a manner as the state of their arts and sciences declares? Or shall we not rather, by the dressing we have received, be stimulated to renewed exertions, and to renewed successes. Our Anglo-Saxon race has never yet fallen back when they see *a* way before them; and now that *the* way is plainly pointed out, we trust all will be up in arms to assist with all their power in this work—absolutely necessary if we are solicitous of regaining our position in many things, and of retaining it still in some few.

ON CHEMICAL AND PHARMACEUTICAL PROCESSES AND PRODUCTS. By JACOB BELL, Esq., M.P. London: D. Bogue. Pp. 72.

After any effort has been made, and the extent of it proved, the mind has leisure to contemplate in quietude, free from all excitement, the means of greater success. That this should ever be the case, is one of the conditions of our being. The Great Exhibition was to do many wondrous things, and it did, and is doing, and will, as we believe, do many wondrous things yet, although they may be deemed to have other parentage. Perhaps, of the multitude of anticipations realised, the chemical observer might have been among those who were best pleased and profited. But now that the grand sight is over, and is becoming more and more a thing of the past, it is probable that the chemist is to be found among those the least gratified, when, with the additional knowledge afforded him, he feels how much more was capable of being done to demonstrate to the world the important position which his

science holds among other sciences. The association of specimens of chemical processes and products, contributed by individuals in competition with each other, with specimens consisting chiefly of raw materials and indigenous or imported products of the *materia medica*, contributed by a number of druggists in their collective capacity, enabled chemists to observe examples of excellences and deficiencies, affording a means of encouraging improvements, and, at the same time, diffusing the necessary knowledge respecting the nature, history, and origin of the innumerable materials employed for chemical and pharmaceutical purposes.

Mr. Bell first notices the magnificent display made by the large chemical manufacturers, and speculates, in a popular vein, upon "their enormous masses of crystals of tartaric and citric acid, the prussiates and chromates of potash, alum, sulphates of copper, iron," &c.; and states that, "round these groups of crystals, ladies frequently assembled, and dwelt upon the introduction of some of the specimens as drawing-room ornaments." A rare time will it be, indeed, when the crystal of the chemist shall take the place of the gorgeous butterfly, or shell, or mineral! The ladies, we opine, will have to employ, first, a few of those hours which are now devoted to the knitting or the crochet-needle, to Liebig and his fellows. There is, certainly, no reason why they should not, although, perhaps, there exist many reasons why they might, with immeasurable advantage to themselves, give up some of their time to more valuable purposes than the construction of table-mats or anti-macassars.

Mr. Bell refers to some single crystals of chrome, alum, sulphate of copper, sulphate of magnesia, &c., which were exhibited by Mr. Copney, as instances of great care in manufacture, and describes the process thus:—

"In the groups before mentioned, the crystals so intersect and crowd upon one another, that no individual crystal is perfect. To attain this latter object, a hot solution of the salt is prepared and set aside to cool: a hair or thread is suspended in the solution to favour the deposition of single crystals. A perfect crystal having been selected and detached from any others which may be adhering to it, is replaced in the mother liquor, to which, from time to time, a small portion of a concentrated solution of the salt is added to feed the growing crystal. If the solution be too strong, groups of small crystals are formed which must be removed. The crystal must be turned every day so as to expose each phase of it in rotation to the same influence. This process of turning and feeding is continued regularly several months, or until the crystal has attained the size required."

The author observes, that he might give numerous examples of improved processes in pharmacy, but that this would possess no general interest, and would be foreign to his purpose, which is to refer to certain principles, and bring forward a few familiar examples by way of illustration. As some of these, he notices the medicinal plants exhibited by Mr. Kent, as being so remarkably well preserved, that many of them possessed all the beauty of the living plant, and in all the specimens the characteristic smell and other properties were unimpaired. As in other things, so in chemicals—"the foreign collections contained many fine specimens, although the British collection was much more extensive and complete." Mr. Bell fairly states, that "some of the leading manufacturers in France and Germany did not exhibit, and that many of the foreign productions, although smaller, were, in other respects, quite equal to those in the British section." He notices particularly the *phloridzine*, containing a bitter principle, obtained from the bark of the root of the pear-tree, and prepared in Italy, where it is in high repute as a substitute for *quinine*, "to which it is said, in some cases, to be superior."

In the department of animal chemistry, some rare organic products were exhibited by Mr. Bullock, such as *kreatine*, *kreatinine*, *urea*, *hippuric acid*, &c.; while Mr. Borden's meat-biscuit, "a convenient form of animal food in a concentrated and portable state," receives, as it greatly deserves, public notice.

A brilliant example of the power we hold in the very ordinary processes of the science, is afforded by what has recently been attained with regard to that beautiful blue pigment, ultramarine, the only source of which was formerly the *lapis lazuli*, an expensive mineral:—

"In 1814, Vauquelin accidentally discovered this product in pulling down a furnace in a soda factory; and from his examination of the substance, he identified it as ultramarine, and concluded that it might be artificially prepared. A reward was offered in France for the process. The composition of the ultramarine from lapis lazuli was known by analysis to be sulphur, silica, soda, and alumina. Yet for a long time it was suspected that these were not the only constituents. Traces of iron and carbonate of lime had been found in some specimens of lapis lazuli; but Messrs. Clement and Desormes ascertained that these were accidental impurities. It had long been known that elements, when chemically combined, often produced compounds totally different in character from the elements; yet the chemists engaged in the investigation anxiously sought for some colouring principle which seemed to have eluded their grasp. M. Guinet solved the mystery in 1828, by a synthetical experiment. He combined the four constituents, and obtained ultramarine; Robiquet, Gmelin, Persoz, and other chemists, afterwards discovered the process. The consequence of the discovery has been, that ultramarine, instead of being a rare luxury, used only by the most eminent artists for especial purposes, is introduced into almost every branch of art and manufacture, in which a bright blue pigment is required; and it may now be obtained at a price ranging from 10s. to 1s. 3d. a pound."

Mr. Bell's ladies, who were so earnestly thinking just now of establishing blocks of crystallised soda, &c. on the marqueterie tables in their drawing-rooms, were doubtless among those who regaled their weariness with the flavour of some of Mr. Masters's "pine-apple ices." They would now be much shocked in being informed that one of the ingenious applications of the science of chemistry consists in "the manufacture of artificial essences of pears, pine-apples, and," as Mr. Bell says, with rather vexatious indefiniteness, "*other* fruits." What on earth may we have been relishing, flavoured with these "ingenious" compounds! "The best imitations," the author goes on to tell us, "are the pine-apple and the jargonelle-pear; the greengage, apricot, black-currant, and mulberry, when properly mixed, are fair imitations." We feel somewhat reassured, when we are told by authority that "they are quite innocuous in the proportions used, namely, a drop or half a drop to the ounce," and that some, if not all of the essences, such as *butyric ether*, are, in fact, in chemical constitution, identical with the particular essence obtained (as this is from the pine) from the fruit itself.

After referring to the allotropic phosphorus lately discovered by M. Schrötter, an Austrian chemist, and by which the dreadful disease occasioned by the fumes of the phosphorus, hitherto used as one of the ingredients in the manufacture of lucifer-matches, is likely to be exterminated, he refers to that peculiar state of things existing in this country, by which, although, as to some articles, we command and obtain the best that can be produced, as to others the demand which we make, coupled with the desirableness of cheapness, causes the foreign producer to adulterate the genuine substance. Although Mr. Bell mentions only scammony and opium as in this predicament, every reader can call to mind many others. It is remarkable that "virgin scammony" should have been looked upon at the Exhibition, by "several foreign professors, lecturers on materia medica, and professors of extensive museums," as a great curiosity.

We conclude this notice with what Mr. Bell states respecting some facts, which cannot be too seriously pondered just now:—

"In conclusion, I may advert to the probable influence of the Great Exhibition in promoting education in chemistry and pharmacy, by drawing attention to the importance of institutions in which these branches of science are taught. In the present state of the law in this country, no school of chemistry or pharmacy can exist, unless liberally assisted by donations and subscriptions. Even the Royal College of Chemistry, notwithstanding the prestige of the name of Prince Albert as its head, would have been in the "Gazette" long ago, if it had not been sustained by royal munificence and public liberality. The school at the Museum of Economic Geology is, I believe, almost entirely supported by public funds. The school of the Pharmaceutical Society has been kept up for some years at an expense of several hundreds per annum."

CORRESPONDENCE.

IRON STEAM-BOATS.

The great increase in the number of iron vessels during the last ten or fifteen years, has drawn my attention to means for rendering them more safe, and I am induced to lay the following remarks before the public by means of your valuable publication.

Much has been done by means of water-tight bulk-heads to increase the safety of iron vessels; but I think much more may yet be done in the same direction, without involving any great expense in construction, or creating inconveniences to counterbalance the advantages. First, then, all iron steamers which carry passengers, and have consequently large cabins, should have a light iron floor, perfectly water-tight, riveted to the lower beams and bulkheads, under the cabin, to serve as a duplicate bottom, should any damage be received by the outer one. The same should be done under the steerage, forecastle, half-deck, &c.; these iron floors to be sheathed with well-seasoned pine on their upper surface. The between-deck hatches should be made of strong boards half-checked into each other, and secured with strong iron bracings. They must be well tarred, parcelled, and secured before leaving port. In fact, there should be a horizontal water-tight division in all the compartments, which would keep the ship afloat although all the under part were full of water, and, at the same time, would keep any water that might enter above the division from descending below.

Secondly—All iron steam-boats of above 150 tons, besides the engine-space, should have at least two compartments fore, and two aft of the engine-space, divided by water-tight bulkheads, making five compart-

ments in all. These are more necessary in the fore part of the vessel, from the greater risk of damage from rocks or collision.

Thirdly—Each compartment should be fitted with iron casings up to the deck, open at the bottom, so that the height of water in any compartment may be ascertained. A pipe should connect each compartment with that of the engine, so that on its being ascertained which compartment contains water, communication may be made between it and the engine compartment, and the bilge and injection pumps set to work to keep it clear. There should also be extra pumps to be brought into gear in time of need, and the donkey-engine for pumping water into the boilers might be adapted to pump the water out of the ship, being worked by steam from the large boilers.

Fourthly—The wooden flooring of the holds round the ship's bottom, up to the between-decks' ceiling, ought to be well fitted together, bolted and caulked; laid with white-lead and felt, and bound over the buts by an iron belt, locking the whole together between the kelson and first ceiling plank.

Lastly—In all passenger-ships, the deck-seats should be made solid, but, at the same time, of light pine. They should be in portable lengths of about six feet each, and secured in such a manner that they may be easily unshipped. They should have cork cushions, well covered with oil-cloth, and about two feet long each. In fact, everything likely to come easily to hand, in a case of emergency, should be made so as to act as a life-buoy.

In conclusion, I think that if the above and like plans had been more generally adopted hitherto, we should have had the public papers less filled with heart-rending accounts of disasters, such as that of the "Birkenhead." I could mention several instances which have come under my personal observation, where many deaths might have been avoided in the manner suggested. Amongst others, I have no doubt, many of your readers have not yet forgotten the case of the steamer "Pilot" on Loch Lomond. This steamer struck on a rock, and had barely time to get sufficiently near the shore to get her passengers safely out, before going down. How would the passengers have looked, and how would the newspapers have read, had this casualty occurred on the wide ocean?

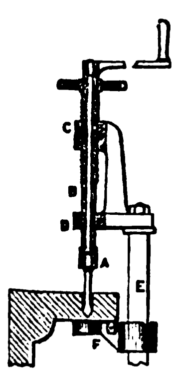
May, 1852. A Steam-Boat Master.

WORKSHOP ECONOMICS.

AMERICAN HAND-DRILL.

The hand-drill, of which the accompanying drawing is a side elevation, (not to scale,) is an American invention, and is, I think, of sufficient importance to merit a place under your heading of "Workshop Economics." The design here given is a little different from the original, which was made of cast-iron, and had a double bar, like the shears of a lathe.

The drill spindle, A, of steel, passes through a tubular spindle, B, one end of which is screwed; the collar of the socket for the drill bears against the end of this tube, and would be all the better if fitted with a little brass cap, the running surfaces being shaped to Schiele's antifriction curve. The screwed end of the tube is tapped into the eye, C, of the stock or frame, and the plain part works through the other eye, D, bored to fit it. On the top of the screw, which is the feeding screw for the drill, a hand wheel is placed, and a long crank handle fits on a square at the top end of the drill spindle, having a small cross pin through to prevent its slipping out. E is a round bar, on which the head, F, may be shifted to suit the work. It is attached to the stock by a screw and nut, so that it may be superseded by a bar of different length, or with a bend, &c., to suit a particular job.



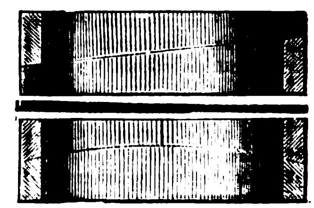
The advantage of this apparatus is, that it requires no fixing; but directly the drill receives the pressure of the screw, the machine is fixed, and it is therefore very convenient for drilling round flanges, or round the manhole of a boiler for the bolts, and such work. It may be also occasionally used, by catching the stock in the vice, for light jobs.

The flange, shown as being bored by the machine, gives an idea of its self-fixing properties, but it is drawn rather out of proportion.

Aladdin.

WEDGE-RING PACKING FOR PISTONS.

I have recently designed a peculiar piston-ring, which, along with great simplicity, has a more regular bearing on the piston and pink-ring than the eccentric-ring now so commonly employed for small engines. My wedge-rings are cast together, and turned on the outside, truly concentric with their interior, and are then set at the desired angle with the face-plate of the lathe, and cut off to the wedge-form in their breadth—the proportions generally used for the eccentric-rings answering very well for the wedge-ring. The objections which I have to the common eccentric form are—that one side being only one-half the thickness of the other, a fair, even, and uniform bearing on the pink-ring and piston is quite unattainable. Then the thin side wears so much in proportion, that steam passes to a very great extent; for, as wear goes on, the ring gets into an oval shape, by reason of the change in the proportions. Suppose a ring one inch thick on one side, and one-half inch on the other, one-eighth inch wear all round alters the relations of thick and thin sides most completely. As a remedy, a more costly form has been introduced, involving extra turning and the cutting of saw-notches all round the inside of the ring. By this expensive mode of construction only is a regular bearing to be attained. Now, in my rings, which I have delineated in transverse section through the cut in fig. 1, and in a similar section at right angles to the openings in fig. 2, they are turned concentrically. The rings are the same thickness all round, but have each a broad side and a narrow one; that is, instead of having a curved wedge in the ring's thickness, I make it a straight wedge in the breadth.



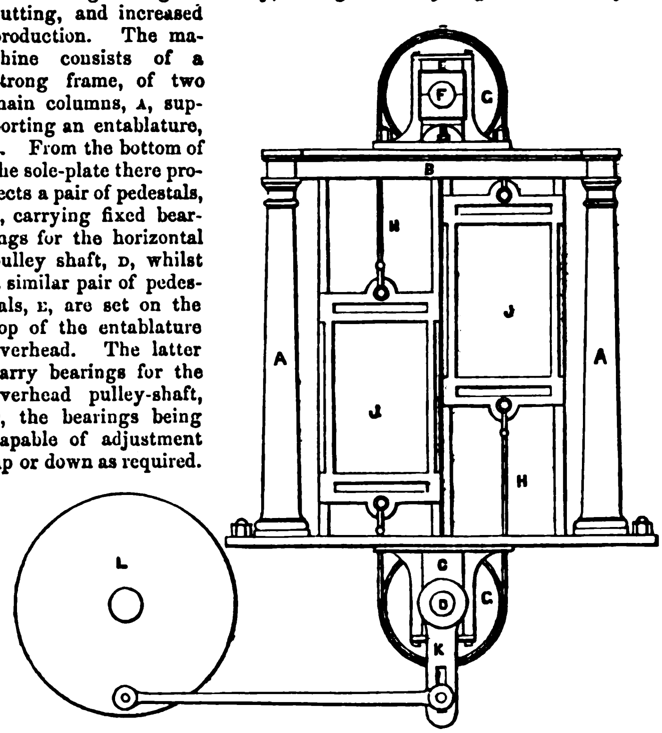
With the exception of the absence of fitting-pieces at the junctions, the rings are shown as ready for use. You will perceive that I get an effect precisely the same as that of the eccentric-ring, whilst I have a uniform thickness all round, and thus obviate the difficulties attending the eccentric form as regards wear. When my rings are turned a little larger than the bore of the cylinder, in the usual way, the elasticity is always uniform, and the ring retains its cylindrical shape.

A. Morton.

Dundee, May, 1852.

BUCHANAN'S SAWING MACHINERY.

The annexed sketch represents a front elevation of a modification of the existing sawing machinery, having for its object greater accuracy of cutting, and increased production. The machine consists of a strong frame, of two main columns, A, supporting an entablature, B. From the bottom of the sole-plate there projects a pair of pedestals, C, carrying fixed bearings for the horizontal pulley shaft, D, whilst a similar pair of pedestals, E, are set on the top of the entablature overhead. The latter carry bearings for the overhead pulley-shaft, F, the bearings being capable of adjustment up or down as required.



Both upper and lower shafts have a band-pulley, G, and each of these pulleys has passed over and attached to its periphery a strap or wire-

rope, H, the opposite ends of which bands are respectively attached to the upper and lower ends of the pair of vertical saw-frames, J. The lower shaft has on one end a slotted crank, K, the adjustable stud of which has jointed to it one end of a horizontal connecting-rod, the opposite end of which is jointed to a crank-pin in the side of the revolving disc, L. Then, as the disc constantly revolves, it causes the crank, K, to vibrate, and thus alternately draws up and down the two saw-frames. The advantage of this arrangement is, that by the screw, F, any required tension may be given to the bands and saw-frames, which form together a species of endless belt, and being well balanced, the saws may run at a very high speed. My calculation of the cutting of a single saw per hour, is 125 feet.

JAMES BUCHANAN.

Patent Saw Mills, Greenock, May, 1852.

[If our correspondent will refer to page 6 of our April part, he will there find particulars of Mr. M'Dowall's sawing machinery, contrived for the very end proposed in the above letter. Mr. M'Dowall, however, proposes to cut with a single saw in each case, instead of the frames; one of his main points, indeed, is to get rid of the frames altogether, giving the required tension to the saws simply by the adjustment of the upper pulley shaft.—ED. P. M. JOURNAL.]

IMPROVED QUILL PEN.

Steel, diamond, and adamantine-pointed gold pens have reached such perfection, that I doubt whether an attempt to bring the poor old quill back into favour will meet with any success. However, my attempt consists in making known a method of treating a quill pen, in use some time by myself, but new, I think, to most people.

It is usual to scrape a little from the centre of the quill where the slit is to be; my plan is, to scrape the sides instead, as shown by the dark parts in the figure. Of course, a quill must be chosen which will split straight, without being scraped in the centre. Hard, but not very thick ones, are the best.

By scraping the centre, the points are made softer and more pliable; but, by scraping the sides, the pen becomes more elastic, at the same time the points remain stronger, though they give way more easily, and the pen, in consequence, lasts much longer without mending.

This pen has made me so fastidious that I cannot write with a quill one made in any other way.

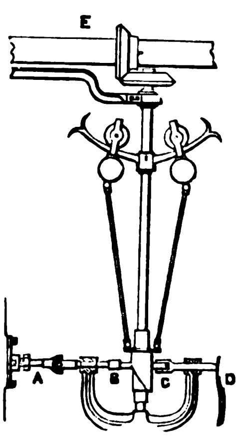
It will not be liked on first trial, however; but it may be made to suit different hands, by scraping off more or less. More must generally be scraped off than would be supposed.

Those will like this pen best who write with a light hand. To the writer who does not like it, I should say, "You are not a good penman."

May, 1852. GOOSE QUILL.

PARABOLOIDAL GOVERNOR.

The figure annexed represents what is called in the catalogue of the Great Exhibition, a "paraboloidal governor." It is by H. D. Schmidt, Vienna, and will no doubt be remembered by many of your readers who passed through the Austrian department of the Crystal Palace. The idea is ingenious, and the communication between the governor balls and the expansion cam is direct and simple, while it will be observed that the connecting rods have great power over the cam, so that the oblique faces of the latter will have but little tendency to restrain the free motion of the balls, as due to the variations in the speed.



In the cut, A, is the expansion-valve rod, the valve being of the lifting order, but placed with the spindle horizontally. There is a universal joint on the rod, for what purpose is not very clear. A coupling, with a cutter through, would probably be better, as the universal joint will soon begin to shake. At B there is an open frame surrounding the cam, and provided with a roller at C, bearing on the cam; at either end of the frame a round rod works through an eye in the light cast-iron frame attached to the step of the upright shaft. The valve is closed by a plate-spring at D. The cam, of course, slides on the upright shaft, having feathers to carry it round. The shaft of the engine (a direct vertical one, with the expansion-valve chest on the back of the slide casing) is at E; and it is only necessary further to remark, that the bevelled wheels for driving the governor must be of equal diameters. ALADDIN.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INSTITUTION OF CIVIL ENGINEERS.

The business of the evenings of the 10th, 17th, and 24th of February, was dismissed by us at the time with a mere notice of its nature. Those who were present on these occasions will agree with us, that there was much that was worth preserving; and those who were not there, will probably now be glad to inform themselves on a subject of so much interest:—

"On the Construction and Duration of the Permanent Way of Railways in Europe, and the Modifications most suitable to Egypt, India," &c., by Mr. W. B. Adams.

This paper was an historical record and critical examination of the various parts, together forming the "permanent way," and of the numerous changes that it had undergone. The requirements that had been gradually developed, as necessary for accomplishing this object, were enumerated, and may be concisely stated to consist in a well-drained substructure, regulated, as regards strength, according to the weight of the engines and the amount of the traffic, firmly seated in the ballast, the rails being stiff enough to resist deflection, sufficiently hard not to laminate, and so broad as not to crush; smooth, so as to offer the least friction, and properly inclined, especially on curves, so as to fit the wheels, and the joints so arranged as to make the bars continuous, and yet to admit of contraction and expansion.

The different kinds of rails, from the flat tyre-bar and edge-rail, used on colliery lines at the time of the introduction of railways, to the parallel and bridge-shape rails now generally adopted, were examined; and also the girder-rails, for doing away with the sleepers and other extraneous means of support, in the hopes of effecting a saving in the cost of maintenance. Of the girder-rails, the saddle-back pattern, introduced by Mr. W. H. Barlow, M. Inst. C.E., was the one most generally known; but it was suggested there would be some difficulty in the packing of this rail, and if, as was asserted, it really was a rigid girder, though the draught might be lessened, the tyre of the wheels would roll down the rails to a corresponding angle with themselves. The mode of connection of this rail, by a piece of nearly similar section, to which it was firmly riveted, was objected to, on the ground of there being no allowance for expansion and contraction, the strength of the joint depending entirely upon that of the rivets. Many modifications in the form of the girder-rail were suggested; among them a T section, with a rail, or rib, on the upper surface, and a vertical portion below, giving stiffness, and forming a solid web for ramming the ballast against.

The supports for the rails were next considered, and the reasons for abandoning stone blocks were attributed, in some degree, to their hardness and rigidity, which caused much noise, but principally to the difficulty of packing and maintaining the way, owing to their depth, to the chairs cutting into the stone, and the spikes working loose. The adoption of timber-sleepers, first on newly-made embankments, afterwards universally,—their size and number to each length of rail, and the proportionate area to the length of bearing,—to the necessity for their being sunk into the ballast, and yet to have such an amount under them as to prevent their being depressed in the ground, was also treated of, and a comparison instituted between cross-sleepers and longitudinal timbers, from which it appeared, that, when their bearing surfaces were equal, the quantity of timber used in each would be the same, and, provided the quality was similar in both cases, which it ought to be, the cost of this portion of the way would also be the same. The longitudinal system certainly afforded great stiffness to the rail, and offered greater facilities for packing; but, on the other hand, the timber was more crushed than in the cross-sleepers, the fastenings were less effectual, and were more difficult of access. For the purpose of obtaining greater durability in this portion of the way, and, at the same time, to preserve the elasticity afforded by the timber substructure, Mr. Reynolds had designed a combination of wood and iron, the wood, to which the rails were attached, being placed in a cast-iron trough triangular in section, with the apex downwards. This system, however, did not meet with much favour; and, more recently, various contrivances had been suggested, and in some instances tried successfully, for doing away entirely with the timber-work in the substructure. In the "dish-cover" cast-iron sleeper, invented by Mr. Greaves of Manchester, and now, it was said, about to be used in the Egyptian Railway, the packing was accomplished from the surface, through two small holes; and, in the system introduced by Mr. P. W. Barlow, the rail was held in two cast-iron vices, which formed so rigid a road, that there was not the slightest elasticity in it. A modification of this plan by Mr. W. H. Barlow, in which the sleeper was cast in one piece, with a chair-head on it, and into which the rail was secured by a wooden key, was a slight improvement on the previous method. Mr. Samuel had proposed that the rail should be held in a compressed wooden cushion, or vice, set in a cast-iron sleeper, or trough, but not continuous; and Mr. Hoby, that the sleeper should consist of an elongated chair of the ordinary form, the rail being fastened in it by means of a pair of folding wedges. From what had been done, it might safely be concluded that cast-iron might be advantageously employed, provided it was in large masses, and formed a continuous support; unless, indeed, the rails were so strong in themselves as to be non-deflecting.

The different modes of fastening the rails in the chairs at the joint, so important to prevent *deraillement*, were then alluded to, and the failure of the wooden keys, at first used, was attributed to their being ridiculously small; iron spikes were substituted for them, but they also were obliged to be abandoned, when larger wooden keys were again adopted; in some instances they were compressed, like the treenails, by the process of Messrs. Ransome and May, who likewise had introduced a chair to be used with them.

The last point to be noticed in the formation of permanent way, was the establishment of a firm connection between the rails, so as to form them into one con-

tinnous bar, and to remove all the evils attending bad joints. On the Blackwall Railway the ends of the rails were originally scarfed (that was previous to the use of locomotives on this line), but this weakened the ends, and reduced the available length of each rail. Subsequently, the addition of fishes on both sides of the rail was proposed. Various modes of accomplishing the same object were given; at first of cast, afterwards of wrought iron, and then only to touch at the top and bottom. These fishes were laid in the channel of the rail, and, in the first place, were supported at the ends by chairs; but as fresh castings had to be made to receive them, it was thought better to have holes in the rails and fishes, and to pass a bolt through all, the holes in the rails being made larger than those in the fishes, so as to allow of expansion and contraction. To meet the objection to the increased cost of this plan, Mr. Samuel, in 1849, proposed that a chair should be cast with only one jaw, to fill one channel of the rail, the other being occupied by the fish.

In Egypt the dry heat of the atmosphere was fatal to timber, and the soil along which the line would be carried would vary from the extreme moisture of irrigated land to parched dust; therefore, the deeper the foundations of a discontinuous sleeper-road could be placed, the better chance there was of their remaining firm. In the flat parts of India two evils had to be guarded against,—the one, the floating up of a line during rainy seasons, if much timber was used; the other, the ravages of the white ant, which might possibly be prevented by creosoted timber; but this, in dry weather, would be liable to be fired either by hot coke or the burning sun. And in both these countries, as well as in the Australasian colonies, where fences and police could not well be maintained, an absence of anything which could be easily pilfered was a great desideratum; there should be few parts, and easily put together, so as to require little skilled labour, where such labour would be dear.

Under all these circumstances, it was submitted that an iron girder-rail, of simple construction, hollow, so as to preserve as nearly a uniform temperature as possible, under the extreme variations of temperature between day and night, would be the most efficacious, the simplest, and eventually the cheapest.

The importance of diminishing the cost of maintenance of way was admitted by all the speakers, and numerous improvements introduced for that purpose were mentioned. Those which appeared to have obtained the most general approval, were Mr. Fowler's long chair; Messrs. Adams' and Richardson's fished joints; Mr. Samuel's fished chairs; Mr. P. W. Barlow's cast-iron sleepers; and Mr. W. H. Barlow's self-supporting, broad-flanged, wrought-iron rails. Each of these systems were shown to possess peculiar qualities, but it appeared to be admitted that the latter combined the greater number of advantages, now that the more powerful machinery of the ironworks enabled heavy rails to be rolled with greater facility, and at a less cost. The asserted rigidity of the iron lines, without timber sleepers, was combated; and it was stated that, from the evenness of the joints, the wear and tear of the rolling stock would be diminished, the cost of maintenance of the permanent way would be materially reduced, and that provision against the effects of the contraction and expansion of a long length of rails riveted together need not be made, as in practice the anticipated effects were not experienced.

It was stated, that the system of fishing the joints had been practised in Germany for some time, and that, as far back as 1838, rails with a hole at each end had been exported from this country; it appeared, however, to be the general opinion, that these holes were not intended for fishes, but for traversing pins to hold down the ends of the rails in the joint chairs; however, within the last few years, the system of fished joints had been introduced with great advantage in Germany.

The numerous varieties of form proposed by Mr. Adams, for inflexible girder-rails, for hollow iron sleepers, for a combination of timber and stone bearings, &c., were discussed; the system of accumulating all kinds of assumed forms was censured, as having a tendency to retard the introduction of improvements by practical engineers; and the compound rails were objected to, as being less substantial at first, and more expensive to renew than Barlow's rail, which, when exfoliated on the surface, could be again rolled, at a cost of less than £2 per ton; the other modifications were not considered to be required, as, with the present experience in railway affairs, with good materials, care in putting them together, and keeping the whole in order, a good travelling road might be made and maintained on any of the usual systems. Up to the present time, a strong bridge-rail, firmly secured to a strong longitudinal balk of timber, soundly packed with dry gravel ballast, and well drained, had been admitted to be, if not the best, to be one of the best kinds of permanent way. It remained to be demonstrated by time what amount of improvement was introduced by the continuous broad-flanged rail, which, it was admitted, did appear to be well adapted for foreign lines; but, with respect to them, it was contended that, in almost all the tropical climates, there were some kinds of timber which resisted the white ant, and those would necessarily be used; but it was probable that the use of iron might be found ultimately more economical, even if it were more costly at the outset.

On the question of stone-block railways, it was urged, that on several lines so constructed, where the traffic was considerable, but the velocity did not exceed ten or twelve miles per hour, the rails lasted well, and the cost of maintenance of way was light; but that, where the velocity was great, the rigidity was objectionable, and caused too much wear and tear of the rolling stock.

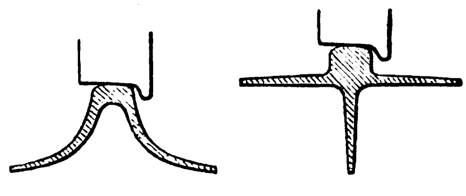
In the various statements of the cost of maintenance of way, it was essential to specify what items were included in each, in order to arrive at any comparison. When iron was cheap, and timber comparatively dear, the proposed system of cast-iron sleepers and of very heavy continuous rails might be advantageously adopted; but in countries where timber was abundant, and iron must be imported, the system of longitudinal timber sleepers and light rails would, of necessity, be adopted.

With respect to the cast-iron sleepers on the South-Eastern Railway, it was stated, in reply to questions, that there was not a greater amount of breakage than with ordinary cast-iron chairs, although the system had been principally tried on a part of the line where the traffic was very heavy and the ballast was very bad, and that the offer of Mr. Taylor, the contractor, to maintain and renew those parts of the line laid with cast-iron sleepers, for twenty-one years, for £100 per annum, sufficiently proved the fact.

It was urged also, that it was impossible to draw any accurate deductions from the expenditure in maintaining a wood sleeper line for six months, as it might appear in the next half year that an apparent saving had been made at the expense of increased deterioration.

It was urged, that the duration of rails must depend on the quality of the iron, the proportion of its weight to the traffic, and the velocity and amount of that traffic; that the question of the cost of maintenance of way was, up to the present time, almost an insoluble problem, the elements being inconstant, no absolutely parallel cases being in existence, and unless all the conditions were distinctly given, no comparison between different systems could be established.

[Setting aside the mere party censure of a patentee by professed rivals, with a specious allegation, as a trade *ruse*, and setting aside also mere opinion, as a very fallible test, the gist of the controversy resolves itself into a mechanical comparison of two rails—one patented by Mr. Barlow, and the other by Mr. Adams. The rail of Mr. Barlow is a trough, with the hollow side downwards, rolled in solid iron. The rail of Mr. Adams is a T girder, also rolled in solid iron, if required, and not necessarily formed of pieces, as assumed. The trough-rail, as will be seen by the sketch below, is a variety of the bridge-rail, wide and shallow, and hollow beneath. The girder-rail, as sketched, possesses great vertical depth and horizontal width for bearing-surface, and being at the same time solid. It therefore combines the deep vertical principle of the chair-rail, with the broad horizontal base of the bridge-rail.



Barlow. Adams.

It will be seen by these diagrams, that, supposing an equal thickness of ballast beneath the surface-bearing of each of these two rails, the trough-rail rises 5½ inches above a base of 13 inches, and the girder rises 2½ inches above a base of 14 inches. Thus the tendency to lateral-working beneath the engine in Barlow's is as 22 to 52; and in Adams' it is only as 10 to 56.

The advantage, therefore, is very largely in favour of the girder as regards bearing-surface and horizontal stability.

The next question is of lateral hold against the side-lurch of the engine.

Supposing both rails to rest on the surface, the trough-rail will have no lateral bearing whatever; but the girder-rail will have 5½ inches of deep keel entering into the ballast, and affording considerable lateral resistance, precisely as a ship with a deep keel resists leeward movement. And this deep keel will also materially tend to preserve stability against lateral rocking.

Again, in the girder-rail, the bearing-surface is all horizontal, or nearly so, while the trough-rail has no horizontal bearing-surface save the apex, which, being above the surface of the ballast, can scarcely be assumed as such, and probably some deduction must be made from the total width to give the real amount of bearing.

The next consideration is the vertical resistance to deflection. The trough-rail has 5½ inches of total depth in a splayed form. The girder-rail has 8 inches of total depth in a vertical form.

Supposing an equal amount of wear on the surface, the tendency of the trough will be to split across the crown of the apex, while the girder will be very little diminished in strength.

In packing the ballast longitudinally, or at an acute angle with the rail, the angles of the girder-rail appear to afford the best hold.

It is stated that, when the trough-rails are worn out by the destruction of the surface, they may be replaced, by re-rolling, at a cost of £2 per ton.

In this case, both rails will be on a par, but we do not believe the statement. We dare say that ironmasters would change the rails on their works for that difference in price; but the cost of unriveting, taking up, and transport, would be considerable.

We think this form of the girder offers greater facilities for forming good joints than the trough does.

With regard to manufacture, the trough-rail takes eight rolls, and the girder-rail would not take more; and the rib of the girder-rail will not cut deeper into the roll than the trough-rail does.

Having thus stated the mechanical bearings of what has been made a "vexed question," we leave it to "practical mechanics" to judge between them as to what are the conditions required in a rail, and which of the twain best fulfils those conditions.—Ed. P. M. Journal.]

March 23, 1852.

"On the Results of the Use of Tubular Boilers, or of Flue Boilers of Inadequate Surface, or Imperfect Absorption of Heat," by Admiral Earl Dundonald.

"A Description of a Diaphragm Steam Generator," by M. Boutigny (d'Evreux.)

MARCH 30.

"An Account of the Drainage of the Town of Richmond, Surrey, under the authority of the Metropolitan Commissioners of Sewers, in 1851," by Mr. George Donaldson, Assoc. Inst. C.E.

APRIL 6.

The discussion on Mr. George Donaldson's paper occupied the whole evening.

APRIL 13.

"Account of a Swing Bridge over the River Rother, at Rye, on the Line of the Ashford and Hastings Branch of the South-Eastern Railway," by Mr. C. May, Mem. Inst. C.E.

APRIL 20.

"The Economy of Railways, as a Means of Transit, comprising the Classification of the Traffic, in relation to the most appropriate Speeds for the Conveyance of Passengers and Merchandise," by Mr. Braithwaite Poole, Assoc. Inst. C.E.

APRIL 27.

"Railway Accidents: their Cause and Means of Prevention; detailing particularly the various Contrivances which are in Use and have been Proposed; with the Regulations of some of the Principal Lines," by Captain Mark Huish, Assoc. Inst. C.E.

MAY 4.

The discussion of the papers of Mr. Braithwaite Poole, on "Economy of Railways," and of Captain Huish on "Railway Accidents," continued throughout the evening.

MAY 18.

"Observations on Artificial Hydraulic or Portland Cement; with an Account of the Testing of the Brick Beam erected at the Great Exhibition;" by Mr. G. F. White, Assoc. Inst. C.E.

INSTITUTION OF MECHANICAL ENGINEERS.

APRIL 28, 1852.

ROBERT STEPHENSON, ESQ., IN THE CHAIR.

"On a Continuous Expansion Steam-Engine," by Mr. J. Samuel. This was a supplementary paper, due to the adjournment on the 28th of January last.

"On a New Mode of Measuring High Temperatures," by Mr. John Wilson, Bridgewater Works, St. Helens.

"On the Expansive Working of Steam in Locomotives," by Mr. D. K. Clark, Edinburgh.

"On a New Portable Lifting Machine," by Mr. J. E. M'Connell, Wolverton.

The business of the meeting was brought to a close with the exhibition of "Bourdon's Manometer," or pressure guage; "Osler's Anemometer Diagrams;" and "Cotterill's Bank Lock."

ROYAL INSTITUTION.

FRIDAY, FEBRUARY 27, 1852.

THE DUKE OF NORTHUMBERLAND IN THE CHAIR.

Dr. Lyon Playfair, C.B., "On three important Chemical Discoveries from the Exhibition of 1851. 1. Mercer's Contraction of Cotton by Alkalies; 2. Young's Paraffine and Mineral Oil from Coal; 3. Schrötter's Amorphous Phosphorus." All these three discoveries have resulted from that made by Berzelius, called Allatropism, which, itself, originated in the observation of the same body possessing different properties. This singular, and but recently ascertained law of matter, was familiarly illustrated by the varying forms of crystal of the same substance. The *dimorphism* of bodies, a term which such forms gave rise to, has long excited much interest. It is now known, that not only may the forms of bodies vary, but that their other physical properties differ also, and sometimes their chemical properties likewise. These facts, as regards crystallized bodies, (which, as crystals, may be considered in their more complete state,) are more readily discovered than in amorphous bodies, or those possessing no apparent crystallization. Several special instances of this change of properties were named, and some interesting experiments exhibited. The lecturer then explained the natures of the three discoveries in detail, that of Mercer being more particularly interesting, by bringing calico, hitherto considered as belonging exclusively to the purely vegetable world, into the domain of chemistry, by demonstrating it to consist of acid properties remarkably acted upon by caustic soda, and producing what Dr. Playfair would call a *colicoate of soda*, important in dyeing and other arts. The discovery of paraffine, by Mr. Young, was stated to have been prophecied by Liebig in his 'Letters on Chemistry;' and the Bog-head coal of Scotland was mentioned as best adapted for the purpose of obtaining the extract which forms the best known oil for lubricating machinery. A singular fact was mentioned as regarded allatropic phosphorus, viz., that 500° of heat converts common phosphorus into the allatropic form of that substance, and that a few more degrees of heat causes its reconversion. The Professor concluded by asserting his opinion, that future investigations into the phenomena of nature would show that there were not so many chemical elements as now there are stated to be.

FRIDAY, MARCH 12.

SIR CHARLES LEMON, BART, M.P., IN THE CHAIR.

Dr. W. B. Carpenter, "On the influence of Suggestion in modifying and directing Muscular Movement independently of Volition." The phenomena exhibited in what has been popularly called Electro-biology, appears to have suggested to the lecturer the subject of the evening. These phenomena have, by many persons, been attributed either to imposture or the effect of the imagination, according as they agreed in supposing the word *science* to be falsely applied to the explanation of such phenomena. The recent history of this popular entertainment had furnished another proof how the credulous reception of facts have often ended by the original sceptic straining at a knat and swallowing a camel. There is another class of persons, and the number of whom is probably increasing, who consider that there is, as it is said, something in it. It was the lecturer's intention to show that none of the phenomena really proceeded from the cause to which they are attributed, but are entirely consistent with our present knowledge of the physical condition of man, and that there really is nothing in the facts which is to be surprised at. The observed effects upon which he founded his conclusions had been well attested by himself and others, upon whose unimpeachable veracity and honour he could rely, and had been produced upon different individuals at Edinburgh. The real efficient cause was making the party operated upon look for some time intently upon a fixed object. Any object would do, provided the attention were abstracted upon it—a disc of zinc and copper, or anything else. This induces a state of artificial reverie. One in twenty, or one in twelve persons, might possess an organization sufficiently sensitive to be affected; and, where a power of abstraction prevails, the individual is the more readily affected. The dogmatic mode of dealing with the subject in this state by saying, "Now, you cannot open your eyes," and now this and now that, suggested the action sought to be induced, and which he maintained had nothing to do with the will (as will) of the operator. The mind in this state was acted upon as an automaton, it being in fact unable to retain more than one idea for some short time. All the movements of the body were thus governed by the suggested idea, not indeed of the operator, but as it becomes impressed upon the mind of the person operated upon, although dependent on the tone and manner of the operator. This being so, great differences take place in the character of the phenomena produced. In some the motor, in others the sensorial faculties are the more acted upon. Many curious and amusing anecdotes were told illustrating the lecturer's position, particularly some instances of what is commonly called "absence of mind." It is true some of the phenomena might be imitated; but others, such as perspiring, shivering, sneezing, &c. could not be imitated with any great success, and all these had been produced, as well as the induction of sleep. Some sensitive subjects had been kept asleep for thirty hours. He would explain all these things by a physiological rationale. He then demonstrated the well-known conditions of the nervous structure, showing the effects of injury to different parts of the spinal cord by the varying peculiarities of muscular movement consequent upon it, and which very satisfactorily accounted for the phenomena.

FRIDAY, MARCH 26.

SIR JOHN P. BOILEAU IN THE CHAIR.

Professor Cowper, "On the Principles of the Construction and Security of Locks." After mentioning the great number of known patents taken out for improved locks, amounting to some ninety, besides twenty others noticed among the proceedings of the Society of Arts, the lecturer remarked that the principles involved in their construction were but few. He first explained the construction of the simplest kind, namely, the pin or Egyptian lock, as it is now called, it having been discovered depicted on one of the ancient sarcophagi in the British Museum. He then detailed the construction successively of those known by the names of the letter lock, the dial lock, the warded lock, Mr. Barrow's lock, in which the tumbler was first used, the Bramah lock, in the making of which for the first time special tools were made for a special purpose, Chubb's lock, comprising as many sometimes as twelve tumblers, and in which the "detector" was first applied; Jones' American permutation lock, Whewell and Day's improvement, and last, Mr. Hobbs' now celebrated piece of ingenuity. In the construction of these, security was of course the aim, and this was attempted to be acquired by increased difficulties, supposed to be placed in the way of those who would overcome them; but experience had proved that security has hitherto depended on the ignorance of the lock-picker. Professor Cowper exhibited practically, on some excellently prepared models and well-drawn diagrams, the points to be considered in the construction of these articles, and how they might best be attained.

FRIDAY, APRIL 2.

SIR CHARLES FELLOWS IN THE CHAIR.

Sir Charles Lyell "On the Blackheath Pebble-bed, and on Certain Phenomena in the Geology of the Neighbourhood of London."

FRIDAY, APRIL 23.

W. POLE, ESQ., M.A., F.R.S., TREASURER AND VICE-PRESIDENT, IN THE CHAIR.

The Rev. Baden Powell, M.A., F.R.S., &c., Savilian Professor of Geometry, Oxford, "On the Analogies of Light and Heat."

SOCIETY OF ARTS.

THURSDAY, JANUARY 15.

JOSEPH GLYNN, ESQ., F.R.S., IN THE CHAIR.

Our readers will well remember—if, indeed, the matter have passed even yet into the region of memory—the controversy on Locks, altered in terms by some wit into "The Lock Controversy," which interested and amused the public while the Exhibition was "about." Our readers will well remember, too, the names of Chubb and Bramah, and, above all, the magical name of Hobbs: associating with the former all difficult modes of constructing locks, and with the latter, all ingenious contrivances for picking them. It was not to be surprised at, therefore, when a room full of the members and their friends assembled together, as did on this evening, to listen for an hour to the real Simon Pure of lock-picking fame—or, ought we to call it rather notoriety—on his kindly volunteering to enlighten the world on what we cannot but call a hard-hearted satire upon mankind. The moment "Mr. Hobbs on Locks" was announced as the paper to be read and discussed this evening, that moment, it seems, all the antagonists in the controversy determined to come and stand bodily forth, and sum up their respective arguments, and challenge for themselves exclusively the admiration and regard of those using these mechanical contrivances—and who, in some form or another, does not?

It must be confessed that Mr. Hobbs had a somewhat difficult position to maintain against the celebrated patentees,—difficult, because imagined unpalatable. However, it must as universally be conceded, that he came to the subject with great good humour, and continued so to the end of the evening.

The proposition with which he started was one founded upon the definition which he would give of a lock as a mechanical instrument, by which property might be absolutely and perfectly secured. "If I show that the locks now commonly considered as attaining this end ought not, properly, to be so considered; and, moreover, if I show a mode of construction of which no one yet has ventured to prove as much, you must give the palm to me, not only as the emperor of picklocks, but as the man who shows you what kind of lock cannot be picked." This, in fact, is the very key of the long controversy which has taken place; and had it been so understood from the first, while he himself would not have been without due honour for his most ingenious labours, Chubb, Bramah, and others, would not have had a breath of scandal breathed upon their own respective useful works.

Mr. Hobbs began by showing the construction of the old form of what is called the Egyptian or pin-lock; he also showed how readily, by obtaining wax impressions of its vulnerable points, it readily yields up the treasures it would not have touched by profane hands. The first modification of this form was made about forty years ago, and another by Mr. Williams in 1839. The objections to its use were pointed out by the facilities they all afforded in being picked with false keys, which were easily made. These, therefore, were in the abstract without utility for purposes of perfect security.

The ring-lock and the letter-lock were also shown to be in the same predicament. Each ring was moved to that position where it was found not to "bind," and retained there until all the rings had been similarly treated, when the "open sesame" formed the best proof of what he said. The letter padlocks, indeed, Mr. Hobbs alleged to be really less secure than the pin-lock. He greatly amused those present in detailing his adventures in picking a lock of something of this description in the Great Exhibition. There were a number of different locks exhibited in one foreign department. Mr. Hobbs was there with a friend. Mr. Hobbs took up the identical thing that was to puzzle the nations, and examining it with educated lock-picking eyes and fingers, soon conceived a means of overcoming the power objected to him. Cutting off a splinter from a wooden bench near him, and quickly forming it to his purpose, and accomplishing that purpose while his friend was otherwise engaging the attention of the exhibitor, he brought forward the lock, and requested him to show the secret of opening it. The exhibitor twisted the rings about, and got the letters into their proper order. "There!" said the exhibitor. But the charm had no effect. The exhibitor, in despair, consulted his memorandum. That *was* the magical word—there was no doubt—but the cause of the non-success was inexplicable, until Mr. Hobbs kindly explained, that in less than the three minutes in which he began and finished his manipulations, he had discovered the key-note, *and had altered it!*

Mr. Hobbs showed the construction of the celebrated Bramah lock, which he had succeeded in picking—to the pocket-loss of £200 to the celebrated and too confident patentee. Mr. Hobbs next demonstrated the non-perfect security of the no less distinguished Chubb form of lock, in which great ingenuity is displayed in the combination of what are called "tumblers;" and concluded by suggesting, that the true mode of construction consisted not in multiplying difficulties which, with patience, might be overcome, but by the application of new principles; and he shortly pointed out the advantages resulting in this respect from the elaborate performance, for which his peculiar genius must be held in high respect.

An interesting discussion followed, in which Professor Cowper, Mr. Gregory, Mr. Hodge, and others took part. The result of which seemed to indicate, that as long as it required so much time and so great ingenuity, in a practised hand, to pick locks, and as long as it would be necessary to give £40 or £50 to become the owner of one of Mr Hobbs' unpickable locks, the locks of Bramah and Chubb—the best of which, for ordinary purposes, might be obtained for less than £3—would lose nothing of their true value for the common purposes to which they are applied.

We may observe that Mr. Hobbs illustrated his paper with actual locks of the various kinds named, and with a series of some of the most excellent artistic drawings and diagrams, of very large size, which it has ever been our fortune to see. We hope other lecturers will take a lesson from what Mr. Hobbs has done in this particular. We rejoice to add, that the unanimous thanks of the meeting were voted to this gentleman, for the instruction and entertainment he had afforded.

WEDNESDAY, JAN. 21, 1852.

CHARLES WENTWORTH DILKE, ESQ., V.P., IN THE CHAIR.

Professor Edward Solly, F.R.S., read his lecture "On the Vegetable Substances used in the Arts and Manufactures, in relation to commerce generally," being the 7th Lecture on the results of the Exhibition. He commenced by observing on the great extent of the subject, and the immense number of items claiming attention, and which, in the aggregate, formed the very foundation of the Arts, Commerce, and Navigation. He must, however, limit what he could say to the principal observations he had made as one of the jury appointed to consider the proper mode of distributing the rewards offered by the Royal Commissioners. The head of "Raw Produce," under which these substances were classed, must not be confined to the simple productions of the field or the garden; but obviously extended to all classes and forms of materials *as they came into the hands of the manufacturer*, for the express purpose of the particular manufacture to which the particular manufacturer devoted his time and attention. There was a very great inequality of representation of these substances within the walls of the Crystal Palace. Some countries who are distinguished in commerce for certain kinds of raw produce were not represented at all, while others were but imperfectly so. He must, of course, content himself with observing upon what had come actually under observation. The conclusion at which he had arrived, after the best attention he had been able to give to the matter, was, nevertheless, as important as if that conclusion had been formed upon a wider survey. That conclusion was, that in our arts and manufactures the best known substances were not used, and the best methods known of using them were not followed. No doubt this arose from the jealous conventionalities of long-continued and self-satisfied practice, and the difficulty of getting out of the routine of old-established custom. The neglect in taking advantage of new discoveries and inventions was, however, without question, mainly attributable to sheer ignorance. Hence manufacturers had been more indebted to chance or accident than to the grasping at rational hope in making progress in their various departments. If an artist or manufacturer happened casually to hear of any new substance likely to work an advantage in his art or manufacture, he searched in vain around for any solid or useful information relating to the matter. Many substances proved to be of great utility were rarely found to have been written upon. This was probably owing to the want of communication between the producer of the raw material and the manufacturer. The former was, therefore, left in ignorance as to the best kind of material required; and the latter was compelled to be content with the substance which reached his hands, he being also ignorant of the mode of production, and even, often, whether it were pure or adulterated. The prejudicial effect, in this respect, of the employment of brokers was insisted upon. These parties might be said to form a complete obstacle to any such desirable communication. Instances were mentioned in which the manufacturer had positively refused to treat commercially with parties, importing new products without the intervention of the broker; and hence, in numerous instances, these new products had been returned to the country of production as commercially useless; whereas, had the really natural method of dealing with such productions been pursued, both commerce and manufacture would have been benefited. The Professor maintained that only where this immediate communication exists between the native producer and the manufacturer does anything like progress take place. The broker never knows anything about a new produce: with him that which has been, is, and ever will be, and that alone. He detailed some singular results of this kind in the substances of *gums* and *resins*, *shell-lac* and *starch*. The useful substances of *caoutchouc* and *gutta percha* were touched upon; and the first sample of the latter introduced into this country lay as a curiosity on the table. Many vegetable *oils*, besides those produced from the cocoa-nut and palm, were enumerated, as well as the curious new substances of *vegetable tallow* and *vegetable wax*. With regard to these preparations, he demonstrated how easily adulterations of them had found their way into arts and manufacture, and the importance in every respect of their being prepared and used pure. After noticing the mode of preparing—by destructive distillation of birch bark—the peculiar oil which the Russians had first introduced, and to which the agreeable perfume was given to "Russian leather," he proceeded to the important subject of *dyeing*, of which very many good illustrations were found in the Exhibition. He explained why a dye for wool or cotton would be inefficient for silk or flax, and noticed the new black dye of New Zealand. He considered that in no department of the arts did chemistry promise to the experimentalist so rich a reward as in the new discoveries it might make of some dyeing principles not yet known. But the laboratory had not yet opened its treasures in this respect, and the old oak bark was continued to be the most largely used, although other substances used with it might aid its effect.

He next entered on the subjects of cotton, hemp, and flax, stating that 800 millions of lbs. of raw cotton were annually imported into the British islands, which were produced from four varieties of the plant. Of all the cotton imported, about 84 per cent. came to us from the United States. He alluded to Mercer's important invention of the treatment of cotton with caustic soda, causing a shrivelling of the fibre, by which the manufactured cotton was made of a finer quality, and capable of better taking any dye. Many specimens of great interest were exhibited. He also referred to the *flax-cotton* of M. Claussen, upon the success of which, however, he was not so sanguine. Singular enough, this flax-cotton, which has lately been considered a completely new substance, was produced and known upwards of 70 years ago; and he read several extracts from the journals of the Society of Arts establishing this curious fact. He then alluded to the curious rather than useful substitutes for flax and hemp, the China grass, cocoa-nut fibre, and other vegetable fibres; and many will, doubtless, remember a multitude of them placed in the north-western gallery of the late Exhibition, near the transept. He also noticed the *silk-cotton*, obtained from a tree, and used in America in the manufacture of hats, for which it is said to be admirably adapted.

Wood and *timber* next claimed his attention; and the importance of this part of his subject may be estimated when it is considered that upwards of 10 millions of cubic feet are annually imported into this country. He referred to the fatal destruction of timber, without the accompanying prudence of making new plantations as the old trees were cut down. It was known, also, that whole forests had been burnt down for the mere purpose of obtaining ashes for manure! The lecturer, likewise, noticed the immense number of examples of different woods exhibited,* being upwards of 1000 in number; among which were many highly valuable, and some exceedingly interesting. One tree, producing some of the specimens, was known to have been of the extraordinary diameter of 14 feet. Mr. Solly also noticed the methods adopted for seasoning woods to prevent, or rather postpone, the natural decay that awaited them. He amusingly mentioned our extreme want of information as to new woods, and instanced particularly a very excellent wood called the African oak, "of which all that is known is that it is not known." He finished an admirable discourse by some practical conclusions, which we prefer giving in his own words when his lecture shall be published, alluding particularly to the difficulty, if not impossibility, of framing a history of any particular substance of interest, scientific, practical, commercial, and statistical, and to the great advantage a student in Germany has in the greatly more enlightened literature of that nation on the subject.

The unanimous thanks of the meeting were voted, as usual, by acclamation, and the lecture was promised to be printed.

Wednesday, January 28.

I. K. Brunel, Esq., V.P., in the Chair.

"On Machines and Tools for working in metal, wood, and other materials," by the Rev. Professor R. Willis, F.R.S.

The Professor commenced by generalizing all the contents of the Great Exhibition into three classes—1. *Raw Materials;* 2. *Products;* 3. *Processes.* Of these, the processes, including machinery, were the most imperfectly represented, in consequence of the impossibility of carrying them on in such a locality. Hence many of the most admirable engines were at rest—such as Nasmyth's hammer and the hydraulic press—and served little purpose of instruction. The effects of the Exhibition stand forward as showing the great desirableness of two things,—1. A more intimate union and scientific confidence between the scientific man and the labourer and mechanic; and, 2. A more intimate acquaintance by one workman with the modes which others adopt in carrying out their ends. Every machine is the result of a kind of rough geometry, and which is capable of application to many more purposes than that for which it is originally framed. The means of duly apportioning the machine constitutes the difficulty in its construction. Many books, published upon the first invention of printing, exhibit the most intricate machines, but which would wear out in a week. He then referred to the modes of dealing with the brute material so as to alter its form to subserve the machinist's purposes—by cutting off, or taking advantage of ductility, or of its fusibility, and casting into moulds. The turning lathe was, perhaps, the simplest of all, and oldest of all, producing what are called *solids of revolution*, which, in fact, are physical demonstrations of the mathematical idea of the generation of a solid. He alluded to the formation of a plane surface, and different processes to attain it. He believed the watchmaker to have been the first to make machines to make parts of machines—alluding particularly to fuzee engines; but stated the difficulty attending literary research on the history of the matter,—English literature being exceedingly defective, although the French was more perfect. In England, Bramah appeared to have been the first engineer who constructed machines for making various parts of his locks. The next machinery of this character was the celebrated block-machinery of Portsmouth. He noticed also other shaping machines, as they are called, and gave numerous instances of the advantage to mechanics of knowing the purpose for which the machine is to be made. The astronomical engineer ought to be a workman of all kinds, to enable him effectually to construct the instruments of observation required. In some matters there may not be necessarily so intimate a connection between the scientific man and the mechanic, (as, for example, between the musical composer and the musical artist,) although in the case of the former it is equally imperative that he should know the powers of the various instruments noted in his score. An examination of the contents of the Exhibition had, as regards this point, shown some singular facts, and, amongst them, it had been observed that manufacturers in one county, or even in one town, appeared not to know how other counties, or even adjoining towns, produced the same things. He complained of the unwillingness to creep out of self, which such a state of things demonstrated, and proved its disadvantages, by saying that the old set of mathematical instruments had not been improved upon since the time of Desaguliers. Professor Willis then displayed some remarkably ingenious models, made for the purpose of showing the working of machines of various kinds. These models were made of card-board, and capable of being taken to pieces, and the pieces put up flat together in a portfolio. They had been constructed by himself, and he hoped to see something of the kind used in all schools, as they were very cheaply produced. In this manner he explained the construction of various intricate machines: the planing machine, with the operation of the Jem-Crow tool of Whitworth; the slotting machine; Brunel's mortice machine, to cut key-ways; machine for cutting *cam* edges, with the improvement upon this, which, *par excellence*, may be termed *the* shaping machine. He could not pass over the subject without adverting to the jealousy existing among manufacturers in adopting each other's improvements, or to the unfortunate position of the patent laws, which no way tended to promote the state of matters which was the most desirable.

* Our suggestions on the subject of beginning a museum with them may be seen in p. 82 of Vol. IV. We are glad to find that these suggestions have been taken up and extended.—Ed. P. M. Journal.

Wednesday, Feb. 18.

Owen Jones, Esq., in the Chair.

Professor J. Forbes Royle, F.R.S., "On the Manufactures of India."—A goodly array of Indian manufactures, from the gold-embroidered Dacca muslins to an ivory toy, were kindly lent by the Directors of the East India Company, for the purpose of illustrating the interesting discourse of the evening. The lecturer first alluded to the acknowledged ancient civilization of India, manifested in all the departments of human industry, except that of the inductive science of the last few centuries; and noticed particularly many truths known to them which, for ages, were considered as having been the discovery only of later periods; as, for instance, the relation of the square of the hypothenuse of a right-angled triangle to the squares of its other two sides—the division of the circle into 360 degrees—the ratio of the diameter to the circumference—and the minute division of the solar year, which, singularly enough, as Sir David Brewster has remarked, differs from our own by three seconds only. He went on to notice some of the raw products of the country, such as the bamboo, the palm leaf, and the shells of the cocoa-nut and gourd, all of which are capable, in the natural state in which they are found, of being applied to some useful purposes, which he detailed. He then divided his subject according as it related, 1st, to the chemical; 2d, to the textile; and 3d, to the manual arts.

Among the topics first mentioned was a very ancient method in use, of converting iron into steel by combining the carbonaceous matter of vegetable fibre necessary for the purpose, and from which we ourselves, with all our appliances, may learn somewhat. What takes them two hours to perform, is not yet done in Sheffield under four hours and a half. This appears to be accomplished by inserting in the crucible the green vegetable with the iron, and not, as we do, the already manufactured charcoal. The excellence of the steel thus produced was shown in swords and daggers, two and three sheathed, one within the other, without the possibility of detecting, unless by the aid of a powerful microscope, the line of junction of the material.

He proceeded shortly to notice an alloy, called badarine, consisting of copper, lead, and tin, used for hookah-badars and water-ewers. Also, gold and silver filagree, glass, enamel, particularly the beautiful yellow enamel of Mysore, pottery, bleaching, dyeing, calico-printing, printing in gold on linen by the application of a thin solution of caoutchouc, lacquer-work, sealing-wax, &c.

In noticing the textile fabrics, he referred to those "webs of woven air"—the Dacca muslins; and introduced an improved model of one of the spinning-wheels, constructed by Professor Cowper from a more intricate one in the Great Exhibition, but combining all its mechanical properties. These muslins are not wrought in a loom, but by the hand. The works of the loom exhibited some beautiful and elaborate examples; such as what is called double-weaving, showing a gold pattern on one side, and a similar pattern in silver on the other, and the same in different coloured silks. Some magnificent specimens of gold and silver tissues were also shown and commented upon, and, of course, some very notable Cashmere shawls. We were told that the patterns on some of these articles were produced in the following singular manner. Children were employed to arrange, or rather disarrange certain conventional forms of different colours, until the artist chose a particular accidental combination of them. Some curious carpets were also shown.

On the third branch of this subject, the lecturer noticed lace, needlework, and embroidery, and the working in stone, bloodstone, agate, jade, and crystal, and carvings in ebony, ivory, and pith. Also, the peculiar art, of which several examples were seen at Hyde Park, of the perforated marble chairs and marble bottles. He likewise referred to the manufacture of articles made from horn and sandal-wood, and to those conventionalities in the fine arts by which the status of the country has, in this respect, been, as it were, stereotyped for centuries. Notwithstanding this, some of their patterns exhibited so much taste that our Government have purchased many of the articles shown in the Great Exhibition, to assist in the schools of design now in course of formation in the large manufacturing districts in the United Kingdom.

Thursday, 11th March, 1852.

Mr. Weigall in the Chair.

Mr. C. Blair Leighton, of the firm of Leighton, Brothers, Chromo-Lithographers, "On their Process of Chromatic Fac-simile Printing, and on Colour Printing in general." After detailing concisely the history of the subject, which, like all such matters, has gradually only attained its present interesting position, Mr. Leighton explained the principle which they were led to act upon at their press, viz., the associating together, as nearly as mechanical processes at present known could, the printer and the artist. Early attempts had been made in this field of practical art, but their great defects consisted in exhibiting in the finished work too much the means of producing the effect attained. This defect has been greatly removed by performing the operation as the artist accomplishes his drawing or picture; first by a rough sketch, and then by the due arrangement of colour. One of the later productions was shown to have been arrived at by eleven distinct blocks and impressions, and others were mentioned as being the result of more than twenty such impressions. These, in fact, were like the successive *touches* or washes of colour by which the artist, in his freedom, as yet, notwithstanding the great advance made in this kind of typography, inimitably deals with his subjects. Examples of the mode of printing in several colours were practically exhibited, and the general process of lithography practically explained. Mr. Leighton also detailed how the effects which were produced were accounted for, by diagrams, showing the microscopic appearance of the stone as it is acted upon. The lecture was, moreover, illustrated by a multitude of specimens of colour-printing by Messrs. Leighton, Haghe, Day, Hanhart, and others, including printed paper-hangings, oil-cloth, silk, &c.

WEDNESDAY, 17TH MARCH.

LORD MONTEAGLE IN THE CHAIR.

James Macadam, Esq., Jun., Secretary to the Royal Irish Flax Society, "On the Production of the Flax Plant, and the various modes of preparing its fibres for Manufacture." After briefly noticing its history from the earliest known times, he showed, by some very excellent enlarged drawings of microscopic appearances, the difference between the fibres of flax and cotton. The best flax, wherever produced, was grown between the 44th and 60th parallels of latitude. Russia stands first as the country of greatest production. It annually produces 150,000 tons, one-half of which is imported into the British islands. Austria produces 65,000 tons annually. France and Belgium also produce large quantities. The Brown-Holland, as the name implies, was originally manufactured solely in Holland, but Ireland now produced the greatest quantity. The Belgic flax was the best, being valued at from £90 to £130 per ton. He alluded to the immense increase of the culture of the plant in Ireland, the yearly value of which now amounts to two millions sterling. The exportation of the article from this country is rapidly increasing. He referred to differences of the peculiar kinds of flax grown in New Zealand and elsewhere. Considerable humidity is essential to the soil, but diversity of soil does not seem to be material. Flax consists of—1. Pure fibre; 2. Ligneous stalk; and, 3. Gum, gum-resin, or glue. The lecturer described the various modes adopted to obtain the pure fibre, divested of the other component parts of the plant, alluding, more particularly, to the improved method, lately introduced, of steeping the plant in water, kept by steam at a uniform temperature of about 80° or 90°. He also noticed M. Claussen's mode of converting the fibre into a material resembling cotton, which, if found practicable, would very greatly increase the demand for flax. He mentioned various of the machines now employed for fining or scutching flax, by striking, scraping, bruising, brushing, and cleaning; and observed that these machines still required further improvement, so as to reduce the present great cost of producing the article ready for the manufacturer. He concluded by suggesting the more general growth of the plant in England, the climate being suitable.

ROYAL SCOTTISH SOCIETY OF ARTS.

MARCH 22, 1852.

"Notice of the recently-discovered Iron district of Cleveland, Yorkshire; with specimens of the large masses of Ironstone now being quarried at Easton-Nab there," by William Campbell, Esq., Civil Engineer, Edinburgh.

"An Account of Experiments on the Minie Rifle at Dalmahoy Moss, with remarks on its use, as proposed in the Army." By Messrs. Dickson and Son, Gunmakers, Edinburgh. Communicated, along with some general views of the principles of this branch of Gunnery, by George Buchanan, Esq., C.E., F.R.S.E.

APRIL 12.

"Description and Drawing of a Bullet-Mould for Minie Rifle Balls," by Mr. Thomas E. Mortimer, Gunmaker, Edinburgh.

"Description of a Portable Apparatus, for Taking, Developing, and Fixing Glass Photographic Pictures in the light, without any dark apartment," by Mr. William M'Craw, 287 High Street, Edinburgh.

"The Patent Striking Electro-Magnetic Clock," invented by Mr. Charles Shepherd, of London, was described by Dr. George Wilson, F.R.S.E. The clock was exhibited in action, together with illustrative models, &c.

APRIL 26.

"On the Manufacture of Red or Amorphous Phosphorus on the large scale at Birmingham, by Messrs. John and Edmund Sturge; with an Account of its Application to the Preparation of Innoxious Lucifer Matches," by Dr. George Wilson, F.R.S.E.

"Account of the Bursting of the Bilberry Reservoir," by James Leslie, Esq., C.E.

"Description of an Instrument by which the Variation of the Magnetic Needle can be determined with a greater degree of accuracy than has been attainable in Field Surveying," by John Adie, Esq., F.R.S.E.

"Description of an Improved Break for Railway Carriages," by Mr. James Boyd Thomson, Mem. Inst. Mech. Engrs., Edinburgh and Glasgow Railway Office, Glasgow.

"Description of two Models of his Explosive Projectile for Artillery, on a Safer Principle than those formerly submitted by him," by Mr. George D. Howell, 23 Home Street, Edinburgh.

MONTHLY NOTES.

DESTINATION OF THE CRYSTAL PALACE.—This is no longer a matter of conjecture. With that foresight and promptitude of action which distinguishes the people of our land from their rulers, scarcely had the fiat of destruction been intimated by the Senate, when a society of monied and influential men organised themselves as a "Crystal Palace Company," whose object it is to preserve what otherwise must have perished for ever. A long advertisement in the daily press announces the project, which is proposed to be founded on the substantial subscription of half a million, in certain shares. All this characterises the singular time in which we live, which is still better shewn by the details, as published, of the intended scheme, and which appear calculated to make the concern a good investment, as well as greatly to benefit the country: still more greatly indeed than did the use to which this magnificent, fairy-like structure was last year applied. On the railroad from London to Brighton, at a distance of 8 miles from London Bridge, stands the Sydenham Station, not much in itself now, but destined to become a place of great importance; for hither, foot by foot, are the iron and glass, which are now in course of removal from Hyde Park to be reconstructed into an improved Crystal Palace, of structure at least as gigantic as that which one day held examples of all the physical industries of the world, and upwards of a hundred thousand people, without inconvenience. We are promised, before a twelvemonth has flown over our heads, that in the midst of a park of 150 acres, a building shall be ready for the visits of other multitudes, who are to be afforded instruction and amusements within its courts more desirable, if possible, than those which were last year the sources of attraction; for in the new building the contents will be studiously arranged for these especial purposes. After securing the purchase and reconstruction of the building, all this will by no means be difficult to realise. The vast resources of the Company will, of themselves, be able to command much, and no doubt a call upon the art and other industry of the country, nay of the world, will be responded to by again pouring into the building specimens of all the admirable products of human ingenuity. Painting and music are also to be prominent features. Statues and fountains, and beautiful shrubs, and trees, and flowers, are to be exposed in still greater abundance than in 1851; and courses of lectures will be daily given, affording reasons for our likings and dislikings, and also explanatory of a greatly improved and better assorted collection of working machines and artistic processes of all kinds. The immediate precincts of the new Palace it is proposed to lay out in walks, shaded and adorned by all the varieties of all her indigenous, and also all the exotic, vegetation which England has acclimatised. But it will be said that Sydenham is a long way from town—that the trouble of getting to it will be so great, and the means so expensive, as to preclude "the people," for whom principally the good work is destined, deriving that advantage from it which it is hoped the scheme will afford. All this, however, in the prospectus published, has been provided for. Within the building itself there is to be a railway station communicating directly, by special trains, with the London Bridge and Bricklayers' Arms Stations; while new lines are contemplated to unite the spot with the Waterloo and Vauxhall Stations. Ten minutes or a quarter of an hour will thus be sufficient for a quiet ride down to Sydenham; which place will also readily be reached by the Brighton and South Coast Railway, from spots in that locality. In addition to this, the fare is to include the admission fee into the building—an excellent device, as we shall almost necessarily couple the small outlay with the exclusive payment *for the journey*, and hence give to what is really but a private speculation after all, the dignity and importance, and consequent influence, of nationality. Refreshments will be provided, with precisely the same restrictions as those which accompanied this department in the original structure; while an efficient and unobtrusive police will watch over all things and all persons, we doubt not, with as great urbanity and attention as distinguished the people's body guard, as we may call them, during the Great Season. We trust the adventurers will, upon performing their promises, meet with the reward they certainly will be entitled to, and which we cannot believe is with them of a pecuniary character only. There are all good names in *the Direction*. Sir Joseph Paxton, also, is to have the superintendence of the winter garden, park, and conservatory, Mr. M. D. Wyatt the regulation of the works, and Mr. Owen Jones that of the decorations; while Messrs. Fox, Henderson, & Co., are again to exercise their mechanical and engineering skill in the re-erection of the great fabric. Really, as we quietly muse in our little studio upon all these things, we are led to wonder what we are coming to; and when we realise what has thus been presented to our hopes, we can no longer think that the grand imagination which gave birth to the new Atlantis, proclaimed so much a fond and foolish fiction, as it spoke beforehand of things that were to come. England must prepare for the commencement of a new era in her civilization, when the Institution is opened on the 1st of May, 1853.

NATAL SUGAR.—A Mr. Morewood, a resident in this new and flourishing colony, has just published the results of an experiment which he has made there in sugar growing. His plantation was 40 acres, and the yield of canes per acre amounted to 75 tons. The proportion of the juice to the cane was 54 per cent., and of sugar to the juice 12 per cent. A sample of the produce has made its way to London, and has undergone a test in one of the first refineries. It is estimated as equal in quality to ordinary Berbice, worth, just now, 32s. per cwt., duty paid. Considering the circumstance of its growth, its grain and quality give fair promise of large returns in future.

IRISH BEET SUGAR.—The first hogshead of sugar ever made in the British Islands, arrived in the port of London the other day from Mount Mellick, in Ireland. This sugar, a sample of which we have before us, is the production of the Irish Beet Root Sugar Company, a concern which promises to do more in the way of "justice to Ireland," than all the baseless schemes of wonder-working politicians, for it introduces a new vent for the industry of those who will work, adds a new branch of manufacture, eminently well fitted to the soil and climate, and gives the country a new and more elevated stand in the commerce of nations. We have only now found out that Ireland is admirably qualified for this important trade. Her beet-root averages 26 tons per acre, whilst the continental growth is only 16 tons. Then, as to yield, the minimum in Ireland is said to be 7½ per cent. against a maximum on the continent of 7 per cent.. Again the Mount Mellick works can produce sugar at a cost of £7 5s. per ton, for the mere process; whilst the foreign cost is £9, although the Irish roots have this year cost 15s., and the continental ones only 12s. 6d. per ton. At present rates, the Irish sugar can be fairly produced at £17, the continental average being £17 15s. per ton. The Mount Mellick works cost £10,000. They employ 160 hands, and have as motive power, two steam-engines of forty-horse collective power, capable of working up 300 tons of roots per week. The present produce of sugar is 20 tons per week. The sample which we have, shows the quality to be excellent, the crystals being firm and pure, and without any of the peculiar flavour once thought to be inseparable from the sugar of beet.

Comparison of a Jonval Turbine with an Overshot Water-Wheel, by Prony's Friction Brake.—The *Franklin Journal* has lately given the following comparison of the effective value of a Jonval turbine, made by Mr. E. Geyelin, for Troy, N.Y., with an overshot wheel:—1st, *Experiment upon an overshot wheel.*—Head and fall, 27 feet; number of revolutions of shaft where the friction brake was applied, 80.

Total weight on lever,	331·50	
Weights raised, including the lever,		366·00
Weight of lever,		34·50
		331·50

Circumference of lever, 71·47 feet. Result, 57·84 horse power.

2d, *Experiment upon a Jonval turbine.*—Head and fall, 19 feet 1½ inches; number of revolutions of shaft where the friction brake was applied, 196.

Weight raised,	46·50 lbs.
Weight of lever,	34·50 "
Part cut off at the end of arm,	1·00 "
Total weight,	82·00 "

Circumference of lever, 71·47 feet. Result, 34·81 horse power.

Power transmitted by a 25 feet diameter overshot wheel, with a fall of 27 feet, to a shaft running at a speed of 80 revolutions (to which the brake was applied), 57·48 horse power.

Estimated loss of effective power on increasing the speed from 80 to 180 revolutions, 2·48 horse power,	57·48
	2·48
Power transmitted to the rollers of the engines,	55·00 horse power.
As the overshot wheel is supposed to have been overloaded, I add to it five per cent. of its effective power, to bring it into its best condition, or 2·75 horse power,	2·75
Making the total power of the overshot wheel, in its best condition, with the rollers running at a speed of 180 revolutions,	57·75 "

By actual experiment, the effect of an overshot wheel, using the same quantity of water, diminishes in the ratio from one to one-third, when the fall diminishes from one to one-half.

If an overshot wheel	25 feet diameter gives	57·75 horse power,
One of	12·5 feet diameter will give	19·25 "
	37·5	77·00

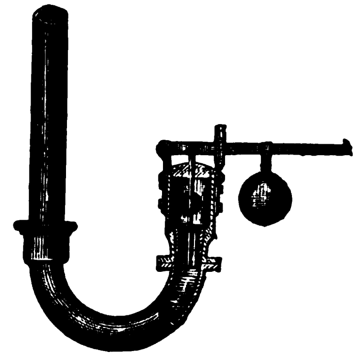
An overshot wheel of 18·75 feet diameter gives 38·50 horse power; if, therefore, an overshot wheel of 18·75 feet diameter gives 38·50 horse power, an overshot wheel of 17 feet 1½ inches diameter, which would be applicable to a fall of 19 feet 1½ inches, using the same amount of water, will give 35·15 H.P. Performance by trial of the Jonval turbine, using the same amount of water as the above-mentioned overshot wheel, with a fall of 19 feet 1½ inches, 35·81 H.P. From observations made by Mr. Tompkins, on the part of Messrs. Manning, Peckham, and Howland (owners of both the overshot wheel and Jonval turbine), and E. Geyelin, on the night of October 30th, 1851, the moveable wheel of the Jonval turbine was found one-quarter of an inch smaller in diameter than the cylinder it revolves in; consequently, the wheel ought to be enlarged $\frac{3}{16}$ths of an inch in diameter. The loss of water through the excess of clearance between the moveable wheel and cylinder existed on July 24, 1851, the time the above-mentioned experiments were made. The circumference of the moveable wheel being 10 feet, and the clearance between the wheel and cylinder $\frac{3}{32}$ds of an inch more than requisite, there was 11·25 square inches through which the water passed without producing any effect. Actual area of the openings of discharge in the wheel, 127·80 square inches; consequently, the power to be added to the power formed by the experiment, as that due to the water escaping through the excess of clearance, will be the 11·35th part of 34·87 horse power, or 3·06 horse power.

Actual power named by trial,	34·81 horse power.
Additional power that can be obtained,	3·06 "
Total power of turbine when properly constructed,	37·87 "

By these results it will be observed that the total power of the Jonval turbine will be 37·87 horse power, when an overshot wheel, in its best conditions, will only give 35·15 horse power. The advantage of the Jonval turbine over the overshot wheel, using the same amount of water, is consequently 7 per cent.

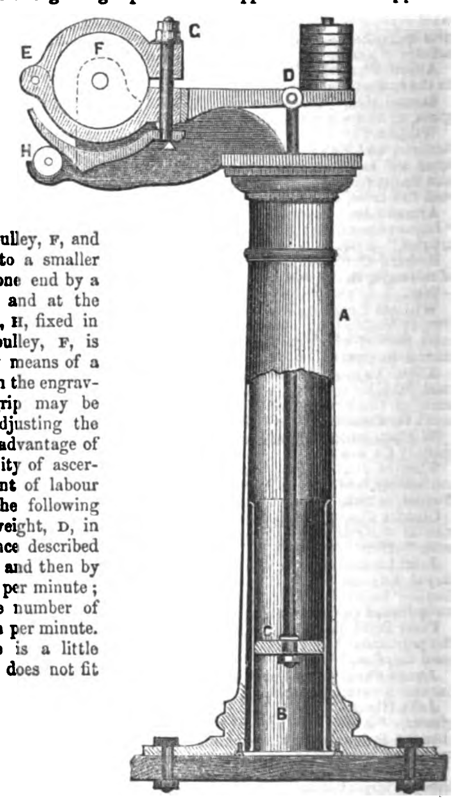
Analogy of Light and Heat.—The capital fact established by Professor Forbes, of the polarization of heat from *dark* sources, (for with *luminous* sources little doubt could exist,) with all its remarkable train of consequences, has finally confirmed the existence of a complete analogy between light and heat—the transverse vibrations, the dipolarization, the consequent interferences, the production of circular and elliptic vibrations under the proper conditions, to those familiar with the wave theory, present an irresistible accumulation of proof of the identity of the rays of heat with the succession of waves in an ethereal medium, exhibiting different properties in *some* dependence on their wave-lengths. Another fact lately established with regard to heat is, the heterogeneity of heating rays, especially from luminous sources. The hypothesis that this heterogeneity consists simply in differences of wave-length seems probable. On this theory the action of heating rays would be described thus:—A body, heated below luminosity, begins to give out rays of large wave-length only. As it increases in luminosity, it continues to send out these, and, at the same time, others of diminishing wave-lengths, till, at the highest stage of luminosity, it gives out rays of all wave-lengths, from those of the limit greater than the red end of the spectrum, to those of the violet end, or possibly less. The peculiar molecular constitution of bodies which determines their permeability or impermeability to rays of any species, gives rise to all the diversities of effect, whether luminous or calorific. We thus escape all crude ideas, at once difficult and unphilosophical, as those either of two distinct material emanations, producing, respectively, heat and light; or of a conversion of one into the other, and obtain a view far more simple and consistent with all analogy.—*The Rev. B. Powell, at the Royal Institution.*

Discharge Valve for Water in Steam Pipes.—One of the simplest contrivances for freeing steam pipes from the water of condensation which we have ever met with, is at present at work at the Cook-street Cotton works, Glasgow. Our figure represents the little apparatus in partial vertical section. A vertical pipe terminates in an elbow, which is fitted with a common weighted lever-valve. The vertical pipe forms a species of reservoir for the water, and the valve is loaded to something over the actual steam pressure in use, so that, when the water accumulates, its columnar pressure, aiding the direct steam pressure, opens the valve, and the water flows off. As the escape goes on, the valve gradually shuts, when the disturbing fluid pressure is sufficiently reduced to restore the equilibrium between the pressure in the pipe and the loaded valve.



Usher's Steam Plough.—In this machine a series of ploughs are mounted in the same plane around an axis, so that they come into action successively; in fact, the ploughs act in the earth in the same way as paddle-wheels do in the water. The engine is mounted on two broad wheels in front, and a broad cylinder behind, and, as it moves on, the earth is ploughed up in a very regular manner. The fore-wheels are fixed to bearings in a horizontal wheel partially toothed on its circumference, being caused to revolve by a small pinion with a handle, enabling the plough to turn at the extremity of a rig. The machine answers equally well on loose as on hard soil, and may have a harrow attached to and following it, to complete the operation. The cost of ploughing by this machine, including wear and tear, is calculated to be about 3s. per acre, in lieu of 10s., which is about the cost of horse-ploughing; and then there is the superior manner in which the work is done. When not employed in ploughing, the engine may be used for driving thrashing and other farm machines.

Labour Machine.—Our engraving represents the application of Mr. Appold's patent dynamometer to a labour machine, as manufactured by Mr. C. Botten, of Crawford Passage, Clerkenwell, and intended for the use of criminals, convicts, &c. Inside a support, A, is a barrel or cylinder, B, with a plunger, C, attached at D to the lever of a jointed break, E, embracing the pulley, F, and connected by a bolt, G, to a smaller bent lever, supported at one end by a knife-edge in the frame, and at the other by a friction-pulley, H, fixed in spring bearings. The pulley, F, is turned by the prisoner by means of a winch-handle, not shown in the engraving. Any amount of grip may be given to the pulley by adjusting the weights at D. The chief advantage of this machine is the capability of ascertaining the precise amount of labour performed—namely, in the following manner:—Multiply the weight, D, in pounds by the circumference described by the handle at F in feet, and then by the number of revolutions per minute; the product will give the number of pounds raised one foot high per minute. In the cylinder, B, there is a little water, and the plunger, C, does not fit quite close to the sides of the cylinder, only allowing the water to pass slowly from one side to the other, thereby offering a resistance to any sudden change in the position of the plunger, but not preventing its being moved slowly. This machine is superior to anything of the kind hitherto produced, whilst the cost is but one-fourth of the treadmill for each man.



ENGLISH PATENTS.

Sealed from 20th March, to 17th May, 1852.

Henry Gustave Delvigne, Brixton, Surrey, gentleman,—"Certain improvements in fire-arms, and in the methods of discharging the same; also improvements in projectiles."—April 17th.

William Edward Newton, Chancery-lane, Middlesex, civil engineer,—"Improvements in machinery or apparatus for cutting paper, pasteboard, or other similar substances."—(A communication.)—17th.

William Edward Newton, Chancery-lane, civil engineer,—"Improvements in the method of, and apparatus for, indicating and regulating the heat and the height and supply of water in steam-boilers, which said improvements are applicable to other purposes, such as indicating and regulating the heat of buildings, furnaces, stoves, fire-places, kilns, and ovens, and indicating the height and regulating the supply of water in other boilers and vessels."—17th.

John Gillett, Brails, near Shipston-on-Stour, Warwick, agricultural implement-maker,—"Certain improvements in ploughs."—17th.

Alfred Vincent Newton, Chancery-lane, Middlesex, mechanical draughtsman,—"Improvements in the manufacture of lenses."—17th

William Henry Dupre and Clement Le Sueur, Jersey,—"Improvements in certain apparatus or apparatuses for preventing smoky chimneys, applicable to other purposes of ventilation."—17th.

Clemens Augustus Kurtz, Manchester, manufacturing chemist, —"An improvement in all preparations of every description of madder roots and ground madder, in or from whatever country the same are produced; also of munjeet in the root and stem, from whatever country."—17th.

Henry Stothert, Bath, engineer,—"Improvements in the manufacture of manure."—A communication.)—17th.

William Hyatt, Old-street-road, Middlesex, engineer,—"Improvements in obtaining and applying motive power."—17th.

John Knowles, Little Bolton, Lancaster, cotton-spinner,—"Improvements in certain machinery for preparing cotton and other fibrous substances, for reversing the direction of motion in, and for regulating the speed of, machines."—17th.

John Trotman, Dursley, Gloucestershire,—"Improvements in anchors."—20th.

Robert Griffiths, Clifton, engineer,—"Apparatus for improving and restoring human hair."—20th.

Robert Reyburn, Greenock, chemist,—"Improvements in printing on silk and other fabrics and yarns."—20th.

William Maddick, Manchester, manufacturing chemist,—"The production of a liquid extract from madder, and its preparations, suitable for the purposes of dyeing or printing, and a new treatment of spent madder, garancine, or garancaux, or other preparations of madder, to render them available for the like purposes."—20th.

John Ridgway, Cauldon-place, Stafford, china manufacturer,—"Certain improvements in the method or process of ornamenting or decorating articles of glass, china, or earthenware, and other ceramic manufactures."—20th.

William Hindman, Manchester, gentleman, and John Warhurst, Newton-heath, near Manchester, cotton-dealer,—"Certain improvements in the method of generating or producing steam, and in the machinery or apparatus connected therewith."—22d.

Edward Hammond Bentall, Heybridge, Essex, ironfounder, and James Howard, Bedford, ironfounder,—"Improvements in the mode of chilling cast-iron."—22d.

James Stevens, Birmingham, glass manufacturer,—"Certain improvements in lamp glasses."—22d.

Alfred Vincent Newton, Chancery-lane, mechanical draughtsman,—"Improvements in the method of manufacturing, and in machinery to be used in the manufacture of wood screws, part of which improvements is applicable to the arranging and feeding of pins and other like articles, and also improvements in assorting screws, pins, and other articles of various sizes."—(A communication.)—22d.

Alfred Vincent Newton, Chancery-lane, mechanical draughtsman,—"Improvements in the mode of priming fire-arms."—(A communication.)—22d.

Samuel Heseltine, the younger, Harwich, Essex, gentleman,—"Improvements in engines, to be worked by air or gases."—24th.

William Church, civil engineer, and Samuel Aspinwall Goddard, merchant and manufacturer, and Edward Middleton, manufacturer, Birmingham,—"Improvements in fire-arms and ordnance, and in projectiles to be used with such or the like weapons; and also improvements in machinery or apparatus for the manufacture of part or parts of such fire-arms, ordnance, and projectiles."—24th.

Armand Jean Baptiste Louis Marceschean, Rue de Moscow, Paris, France, gentleman,—"Improvements in the mode of conveying letters, letter-bags, and other light parcels and articles."—24th.

Richard Christopher Mansell, Ashford, Kent,—"Improvements in the construction of railways, in railway rolling stock, and in the machinery for manufacturing the same."—24th.

William Exall, Reading, Berks, engineer,—"Improvements in the process, composition, or combination of materials, machinery, and apparatus for making bread and biscuits, part of which machinery is applicable to the mixing and kneading of plastic substances in general."—(Partly a communication.)—27th.

Alfred Taylor, Warwick-lane, London, and Henry George Frast, Herbert-street, North-road, Middlesex,—"Improvements in heating and supplying water for baths and other uses, in the construction of water-closets, and in supplying them with water, and in cocks for drawing off liquids."—27th.

William Newton, Chancery-lane, Middlesex, civil engineer,—"Improvements in machinery for weaving, colouring, and marking fabrics."—(A communication.)—28th.

Thomas Richardson, Newcastle-upon-Tyne,—"Improvements in treating matters containing lead, tin, antimony, zinc, or silver, and in obtaining such metals or products thereof."—28th.

Charles Fisher, South Hackney, Middlesex,—"Improvements in transferring ornamental designs on to woven or textile fabrics, and in the apparatus connected therewith."—29th.

John Lintorn Arabin Simmons, Oxford-terrace, Hyde-park, Middlesex, Captain in the Royal Engineers, and Thomas Walker, Brunswick Ironworks, Wednesbury, Stafford, Esq.,—"Improvements in the manufacture of ordnance, and in the construction and manufacture of carriages and traversing apparatus for manœuvring the same."—29th.

Peter Bruff, Ipswich, Suffolk, civil engineer,—"Improvements in the construction of the permanent way of rail, tram, or other roads, and in the rolling stock or apparatus used therefor."—29th.

James Fletcher, Leyland, Lancaster, bleacher,—"Improvements in machinery or apparatus for stretching and dyeing woven fabrics."—29th.

John Hincks, Birmingham, manufacturer, and Eugene Nicolle, Birmingham, civil engineer,—"A new or improved composition, or new or improved compositions, and machinery for pressing or moulding the same, which machinery is also applicable for moulding or pressing other substances."—29th.

George Goodman, jun., Birmingham, Warwick, manufacturer,—"An improved method, or improved methods, of ornamenting japanned metal and papier-maché wares."—29th.

Stewart M'Glashen, Edinburgh, Scotland, sculptor,—"The application of certain mechanical powers for lifting, removing, and preserving trees, houses, and other bodies."—29th.

John Robinson, Rochdale, Lancaster, timber merchant,—"Improvements in machinery or apparatus for shaping wood into mouldings and other forms."—29th.

John Cumming, Paisley, Renfrew, North Britain, pattern designer,—"Improvements in the production of surfaces for printing or ornamenting fabrics."—29th.

Alexander Parkes, Pembrey, Carmarthen, chemist,—"Improvements in obtaining and separating certain metals."—May 1st.

Hugh Lee Pattinson, Scot's-house, Newcastle-on-Tyne, manufacturing chemist,—"Improvements in smelting certain substances containing lead."—1st.

John Moore, Arthur's-town, Wexford,—"Improvements in nautical instruments applicable for ascertaining and indicating the true spherical course and distance between port and port."—1st.

James Johnson, Waterloo-place, Kingsland, Middlesex, hat manufacturer,—"Certain improvements in the manufacture of hats."—1st.

Thomas Mosdel Smith, Hammersmith, gentleman,—"Improvements in the manufacture of wax candles."—1st.

William Wood, Pontefract, York, carpet manufacturer,—"Improvements in the manufacture of carpets and other fabrics, and in apparatus or machinery connected therewith."—1st.

Charles Thomas, Bristol, soap manufacturer,—"Improvements in the manufacture of soap."—1st.

Edward Gee, Liverpool, merchant,—"Improvements in apparatus for roasting coffee and cocoa."—1st.

Henry Bridson, Bolton, Lancaster, bleacher,—"Improvements in machinery for stretching, drying, and finishing woven fabrics."—1st.

Augustus Siebe, Denmark-street, Soho, Middlesex, engineer,—"Improvements in machinery for manufacturing paper."—(Communication.)—1st.

Alfred Vincent Newton, Chancery-lane, Middlesex, mechanical draughtsman,—"Improvements in the manufacture of printing surfaces."—(Communication.)—1st.

Richard Archibald Brooman, of the firm of J. C. Robertson & Co., Fleet-street, Middlesex, patent agent,—"Improvements in paddle-wheels."—(Communication.)—4th.

Richard Jordan Gatling, New York,—"Certain improvements in machinery for seeding grain."—4th.

George Robins Booth, Wandsworth-road, Surrey,—"Improvements in the manufacture of gas."—8th.

George Frederick Muntz, jun., Birmingham,—"Improvements in the manufacture of metal tubes."—8th.

Joseph Jepson Oddy Taylor, Gracechurch-street, London, naval engineer,—"Improvements in ships, boats, and vessels, and in certain articles of ship's furniture."—8th.

William Littell Tizard, Aldgate, High-street, London, brewers' engineer,—"Improvements in machinery, apparatus, and processes for the preparation of grain, and for its conversion into malt, saccharine, vinous, alcoholic, and acetous liquors."—8th.

Alexandre Jules Saillant, jun., Rue Vivienne, Paris, tailor,—"Certain improvements in the manufacture of articles of dress."—8th.

John Campbell, Bowfield, Renfrew, N.B., bleacher,—"Improvements in the manufacture and treatment, or finishing of textile fabrics and materials, and in the machinery, or apparatus, used therein."—8th.

William Gillespie, of Torbane Hill, Linlithgow, Scotland, gentleman,—"An improved apparatus, instrument, or means for ascertaining or setting off the slope or level of drains, banks, inclines, or works of any description, whether natural or artificial, or under land or water."—8th.

William Armitage, Manchester,—"An improved safety envelope, and certain improvements in the machinery to be used in the manufacture of the same."—8th.

Peter Fairbairn, Leeds, York, machinist, and Peter Swires Horsman, of Leeds aforesaid, flax-spinner,—"Certain improvements in the process of preparing flax and hemp for the purpose of heckling, and also machinery for heckling flax, hemp, China grass, and other vegetable fibrous substances."—8th.

Samuel Hall, Manchester, Lancaster, agent,—"Certain improvements in the construction of cocks, taps, or valves."—17th.

George Frederick Parratt, Piccadilly,—"Improvements in life-rafts."—17th.

William Edward Newton, Chancery Lane, Middlesex, civil engineer,—"Improvements in the construction of docks, basins, railways, and apparatus connected therewith for raising or removing vessels or ships out of the water, or on to dry land, for the purpose of preserving or repairing the same."—(A communication.)—17th.

SCOTCH PATENTS.

Sealed from 22d March to 22d May, 1852.

Richard Archibald Brooman, of the firm of J. C. Robertson & Co., 166 Fleet-street, London, patent agents,—"Improvements in presses and pressing, in centrifugal machinery, and in apparatus connected therewith, part or parts of which are applicable to various useful purposes."—March 24th.

Colin Mather, Salford, Lancaster, machine-maker, and Ernest Rolffs, Cologne, Prussia, gentleman,—"Certain improvements in printing, damping, stiffening, opening, and spreading woven fabrics."—24th.

James Melville, of Roebank Works, Lochwinnoch, Renfrew, North Britain, calico printer,—"Improvements in weaving and printing shawls and other fabrics."—29th.

Alexander Forfar, Milnathort, Kinross, Scotland, builder,—"Improvements in ventilation, and the prevention of smoky chimneys."—29th.

Joseph Jones, Bilston, Stafford, furnace builder,—"Certain improvements in furnaces, and in the manufacture of iron."—29th.

Sir John Scott Lillie, Pall-mall, Middlesex, Companion of the Most Honourable Military Order of the Bath,—"Certain improvements in the construction and covering of roads, floors, walls, doors, and other surfaces."—April 2d.

William Watson Patterson, Felling New House, Gateshead, manufacturing chemist,—"Improvements in the manufacture of chlorine."—2d.

George Mills, Southampton, Hants, engineer,—"Improvements in steam-engine boilers, and in steam-propelling machinery."—2d.

Alexandre Hédiard, Rue Taitbout, Paris, France, gentleman,—"Certain improvements in rotary steam-engines."—5th.

Joseph Pimlott Oates, Lichfield, Stafford, surgeon,—"Certain improvements in machinery for manufacturing tiles, quarries, drain pipes, and such other articles as are or may be made of clay or other plastic substances."—6th.

Russell Sturgis, 8 Bishopsgate-street, London, merchant,—"Improvements in weaving looms."—8th.

Richard Archibald Brooman, of the firm of J. C. Robertson & Co., 166 Fleet-street, London, patent agents,—"Certain improvements in the treatment and preparation of fibrous and membraneous materials, both in the raw and manufactured state, in applying electro-chemical action to manufacturing purposes, and in the manufacture of saline and metallic compounds."—10th.

Thomas Barnett, Kingston-upon-Hull, York, grocer,—"Improvements in machinery for grinding wheat and other grain."—13th.

Charles William Siemens, Birmingham, Warwick, engineer,—"An improved fluid meter."—15th.

Richard Roberts, Manchester, Lancaster, engineer,—"Improvements in machinery or apparatus for regulating and measuring the flow of liquids, also for pumping, forcing, agitating, and evaporating fluids, and for obtaining motive power from fluids."—16th.

William Whitaker Collins, Buckingham-street, Adelphi, civil engineer,—"Certain improvements in the manufacture of steel."—16th.

John Hack Winslow, Troy, New York, United States of America, iron-master,—"Improvements in machinery for blooming iron."—16th.

William Hyatt, Old Street-road, Middlesex, engineer,—"Improvements in applying and obtaining motive power."—16th.

Martyn John Roberts, Woodbank, Gerrard's Cross, Bucks,—"Improvements in galvanic batteries, and obtaining chemical products therefrom."—April 19th.

Francois Joseph Beltzung, Paris, France, engineer,—"Improvements in the manufacture of bottles and jars, of glass, clay, gutta percha, or other plastic materials, and caps and stoppers for the same, and in pressing and moulding the said materials."—19th.

John Walton de Longueville Giffard, Serle-street, Lincoln's-inn, barrister-at-law,—"Improvements in fire-arms and projectiles."—19th.

William Gorman, Glasgow, Lanark, North Britain, engineer,—"Improvements in obtaining motive power, which improvements, or parts thereof, are applicable to measuring and transmitting aeriform bodies and fluids."—20th.

William Edward Newton, Office for Patents, 66 Chancery-lane, Middlesex, civil engineer,—"Improvements in the method of, and apparatus for indicating and regulating the heat and the height and supply of water in steam boilers, which said improvements are applicable to other purposes, such as indicating and regulating the heat of buildings, furnaces, stoves, fireplaces, kilns, and ovens, and indicating the height, and regulating the supply of water in other boilers and vessels."—23d.

Alfred Vincent Newton, Office for Patents, 66 Chancery-lane, Middlesex, mechanical draughtsman,—"Improvements in the manufacture of lenses."—26th.

Matthew Urlwin Sears, 36 Burton Crescent, St. Pancras, Middlesex, commission agent,—"The improved construction of guns and cannons, and manufacture of cartridges for the boring and charging thereof."—26th.

Thomas Bell, Don Alkali Works, South Shields,—"Improvements in the manufacture of sulphuric acid."—28th.

Stewart M'Glashen, Edinburgh, N.B., sculptor,—"The application of certain mechanical powers to lifting, removing, and preserving houses, trees, and other bodies."—28th.

Alfred Vincent Newton, Office for Patents, 66 Chancery-lane, Middlesex, mechanical draughtsman,—"Preventing the incrustation of steam boilers, which incrustation is also applicable to the preservation of metals and wood."—28th.

Alfred Vincent Newton, Office for Patents, 66 Chancery-lane, Middlesex, mechanical draughtsman,—"Improvements in the method of manufacturing, and in machinery to be used in the manufacture of wood screws, part of which improvement is applicable to the arranging and feeding of pins, and other like articles; and also improvements in assorting screws, pins, and other articles of various sizes."—30th.

George Frederick Muntz, jun., Birmingham,—"Improvements in the manufacture of metal tubes."—May 3d.

William Gillespie, Torbane Hill, Linlithgow, Scotland, gentleman,—"An improved apparatus, instrument, or means for setting-off the slope or level of drains, banks, inclines, or works of any description, whether natural or artificial, or under land or water."—5th.

William Thomas, Exe Island, Devonshire, engineer,—"Certain improvements in the construction of apparatus and machinery for economising fuel in the generation of steam, and in machinery for propelling on land or water."—5th.

Julian Bernard, Guildford-street, Russell-square, Middlesex, gentleman,—"Improvements in the manufacture of leather or dressed skins, of materials to be used in lieu thereof, of boots and shoes, and in materials, machinery, and apparatus connected with, or to be employed in such manufactures."—10th.

John Campbell, Bowfield, Renfrewshire, North Britain, bleacher,—"Improvements in the manufacture and treatment or finishing of textile fabrics and materials, and in the machinery and apparatus used therein."—10th.

Richard Christopher Mansell, Ashford, Kent,—"Improvements in the construction of railways, in railway rolling-stock, and in machinery for manufacturing the same."—10th.

George Leopold Ludwig Kufahl, Christopher-street, Finsbury-square, London, engineer,—"Improvements in fire-arms."—11th.

David Dick, Paisley, Renfrewshire, North Britain, machine-maker,—"Improvements in the manufacture and treatment or finishing of textile fabrics and materials."—11th.

Charles Ewing, Bodorgan, Anglesea, steward and gardener,—"An improved method or methods of construction applicable to architectural and horticultural purposes."—11th.

Anthony Granara, Leicester Place, Leicester Square, Middlesex, hotel keeper,—"Improvements in apparatus for lubricating machinery."—14th.

Clemence Augustus Kurtz, Manchester, Lancaster, manufacturing chemist,—"Improvements in all preparations, of every description of madder roots and ground madder, in and from whatever country the same are produced; also in mungeet, in the root and stem, from whatever country."—17th.

William Watt, Glasgow, Lanark, North Britain, manufacturing chemist,—"Improvements in the treatment and preparation of flax, or other fibrous substances."—17th.

Peter Fairbairn, Leeds, Yorkshire, machinist, and Peter Swires Horsman, Leeds aforesaid, flax spinner,—"Improvements in the process of preparing flax and hemp for the purpose of heckling; also machinery for heckling flax, hemp, China grass, and other vegetable fibrous substances."—17th.

William Edward Newton, Office of Patents, 66 Chancery Lane, Middlesex, Civil Engineer,—"Improvements in the manufacture of coke, and in the application of the gaseous products arising therefrom to useful purposes."—19th.

IRISH PATENTS.

Sealed from 21st March to 19th May, 1852.

Thomas Barnett, Kingston-upon-Hull, York, grocer,—"Certain improvements in machinery for grinding wheat and other grain."—March 22d.

Russell Sturgis, 8 Bishopsgate-street, London, merchant,—"Improvements in weaving looms."—31st.

Alexandre Hédiard, Rue Taitbout, Paris, France, gentleman,—"Certain improvements in rotary steam-engines."—31st.

Henry Bernoulli Barlow, Manchester, Lancaster, consulting engineer and patent agent,—"Improvements in preparing and dressing hemp and flax, and in the machinery employed therein."—April 5th.

Joseph Pimlott Oates, Lichfield, Staffordshire, surgeon,—"Improvements in machinery for manufacturing bricks, tiles, quarries, drain pipes, and such other articles as are made of clay or other plastic substance."—May 4th.

George Torr, Chemical Works, Frimley Lane, Rotherhithe, animal charcoal burner,—"Improvements in the burning animal charcoal."—17th.

DESIGNS FOR ARTICLES OF UTILITY.

Registered from 15th April, to 20th May, 1852.

April 15th, 3217 George Bower, St. Neot's, Hants,—"Gas cooking stove."
— 3218 H. J. & D. Nicoll, Regent-street,—"Front part of a double-breasted coat."
— 3219 W. Longdon, Manchester,—"Safety noseband."
17th, 3220 R. Mead and Sons, Frome, Somerset.—"Hat body."
— 3221 G. Bowden, Little Queen-street,—"Porte tableau, or artist's sketch and painting safety portfolio."
21st, 3222 I. Harris and H. Shorthouse, Kingsbury,—"Turnip-cutting machine."
22d, 3223 P. Hunter, Edinburgh,—"Churn."
— 3224 I. Firkins and Co., Worcester,—"Gloves."
— 3225 F. Ayckbourn, Guildford-street, Russell-square,—"Apparatus for supporting persons in the water."
23d, 3226 W. M'Lennan, Glasgow,—"Apparatus for moulding and attaching shoe soles."
April 23d, 3227 C. Farrow, Great Tower-street,—"Self-closing valve."
— 3228 C. Baker, Rotherfield-street, Islington, and W. G. Gardiner, Wellsford, Somersetshire,—"Fire-escape, or servant's safety-guard."
24th, 3229 J. Murphy, Newport, Monmouthshire,—"Tyre for wheels."
— 3230 T. K. Baker, Fleet-st., City,—"Lever cock or hammer for fire-arms."
26th, 3231 F. Mason, Ipswich,—"Reaping machine."
27th, 3232 J. B. Palmer, Wednesbury,—"Mould for projectile."
28th, 3233 L. N. Le Gras, Tennison-street, Lambeth,—"Aerated liquor bottle-stopper."
29th, 3234 Hargrave, Harrison, & Co., Wood-st., Cheapside,—"Parasol cane."
30th, 3235 W. I. H. Rodd & Co., Little Newport-street,—"Filter tap."
May 1st, 3236 J. Graham and J. James, Birmingham,—"Carpet bag."
— 3237 G. Fletcher & Co., Wolverhampton,—"Portable bedstead."
3d, 3238 C. Maschurtz, Birmingham,—"Match box."
— 3239 Morris & Son, Astwood-bank, near Redditch,—"Needlecase."
— 3240, 3241 A. Stuart, Edinburgh,—"Script type, to be called 'The American mercantile script.'"
5th, 3242 L. Glyde, Hastings,—"Air-tight valve for beer engines."
— 3243 M. Buck, Skeyton, Norfolk,—"Currant dressing machine."
7th, 3244 G. Holcroft, Manchester,—"Steam-boiler."
— 3245 S. Woodbourne, Liss,—"Horse-rake."
10th, 3246 W. Dray and Co., London-bridge,—"Right and left hand hill-side plough."
11th, 3247 A. Marion and Co., Regent-street,—"Combined pen-cleaner and stopper."
12th, 3248 J. Winterbottom, Yorkshire,—"Jar and bottle-stopper."
— 3249 R. Marples, Sheffield,—"Pad for joiners' brace."
— 3250 G. Thonger, Northampton,—"Fly catcher."
14th, 3251 Fowler and Fry, Bristol,—"Brick die."
— 3252 G. Walsh, Halifax,—"Beer-engine suction."
— 3253 E. Cockey & Sons, Frome,—"Heating boiler."
17th 3254 R. W. Savage, St. James's Square,—"Invisible door-spring."
— 3255 T. Beckett, Manchester,—"Spindle gauge."
18th, 3256 Collins Brothers, Birmingham,—"Crayon holder."
19th, 3257 F. Richmond and P. Chandler, Salford,—"Chaff machine."
— 3258 Guest and Chrimes, Rotherham,—"Water-closet service box."
— 3259 T. D'Almaine & Co., Soho Square,—"Hopper escapement for piano-forte."
20th, 3260 P. A. L. de Fontainemoreau, Finsbury,—"Self-indicating altometer."
— 3261 E. Williams, George Street, Borough,—"Machine for making balls of boiled sugar."

DESIGNS FOR ARTICLES OF UTILITY.

Provisionally Registered, from 15th to 19th May, 1852.

April 15th, 398 Webb and Greenway, Birmingham,—"Bolt."
17th, 399 I. S. Cockings, Birmingham,—"Fastening for gloves, garters, parasols," &c.
— 400 W. D. Richmond, Birmingham,—"Temporary binding for periodicals," &c.
— 401 W. D. Richmond, Birmingham,—"Corkscrew."
— 402, 403 B. R. Moore and J. Moore, Clerkenwell-close,—"Antifriction bearings or supports for a revolving lantern, or lights of a lighthouse."
— 404 Captain M. C. Maher, Taunton,—"'Mars' bullet for fire arms."
19th, 405 W. Hall and S. Lilly, Birmingham,—"External and internal screw lock."
23d, 406 F. Mason, Ipswich,—"Reaping machine."
26th, 407 L. Schmitthenner, Agar-street, Strand,—"Shirt-front."
29th, 408 S. Foist, Birmingham,—"Tap and valve."
29th, 409 H. Maling, Home-office,—"Elevation-sight for ball-shooting."
— 410 H. Maling, Home-office,—"Projectile for a smooth or rifle-barrelled gun."
30th, 411, 412 H. Maling, Home-office,—"Forms of rifling for fire-arms."
May 4th, 413 H. M'Lean, R.N., Horton-street, Kensington,—"Writing, reading, and music-desk and travelling-case."
10th, 414 Thomas Baylis, Strand,—"Omnibus-steps."
12th, 415 G. M. Ford, Portland-road,—"Valve."
— 416 E. Cotterill, Birmingham,—"Letter-box."
— 417 T. Rooke, Jun., Birmingham,—"Tubular oil-cloth cover for cornice-poles."
17th, 418 J. Wright and G. Harrington, Camberwell,—"Official and corresponding envelope."
19th, 419 J. Classon, Dublin,—"Steamboat and railway chess-board and men."
— 420 J. L. Stevens, Kensington,—"Flower or shrub-fastener."

TO READERS AND CORRESPONDENTS.

A Working Man, Bolton.—This information has been given in countless published works. "Lead," means the extent to which the valve is set *before* the crank. In other terms, it is the amount of valve opening at the time the crank is on the centre. "Lap," is the covering-part added to the valve on each end, for the purpose of obtaining an early cut-off. The subject is thread-bare, and is, at any rate, better fitted for a set treatise on the steam-engine than for pages like ours. His Mechanics' Institution ought to afford him both "Bourne's Catechism on the Steam-Engine" and "Clarke's Railway Machinery." In either of these he will find all that can be said on the subject.

Tau-Alpha, Ireland.—His boiler would be difficult to make, and we do not see how he could possibly secure the immense heating area already given by the tube system. But if he will sketch, and more fully develop, his plans, we will consider them. His mode of conveying the motion of the piston to the crank is very old, and, what is worse, very bad. All detents, bands, and lever combinations are perfectly useless. His last proposal is already carried out in more than one form.

J. H. R.—Friction, and the irregularities of the pipe, are great helps to failure,—that is, if perfect tightness has been secured. But he must also remember that the elasticity of the air, lodging in the most elevated bends, has a very injurious effect. Some air will get in; and, wherever there are difficult bends, there it will accumulate, and act as a constant plague.

Constant Reader.—We shall have something to say on this subject next month.

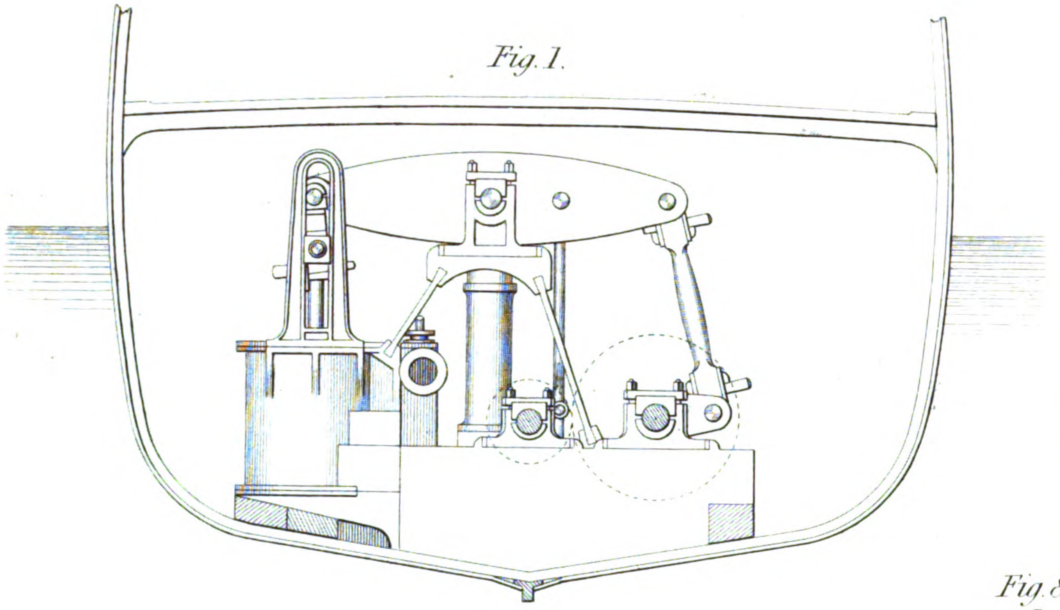
J. H., Munich.—We are obliged by his favour, of which we shall duly avail ourselves in July.

A. M.—We have never seen an engine of the kind he mentions, nor do we believe it has ever been proposed. As a novelty, possessing some interest, we shall be glad to hear further of his design.

S. H. wishes to know "What *size* and *length* the wire in the primary and secondary coils of a magneto-electric-coil machine must be, so as to produce the maximum effect, when excited by a Smee's battery?—the answer to be the result of actual experiment."

Received.—"The Stearic Candle Manufacture," by G. F. Wilson, Esq.—"Popular Explanation of the Pendulum Experiment," by B. Mitford.—"Machinery of the 19th Century," Part 4.

Fig. 1.



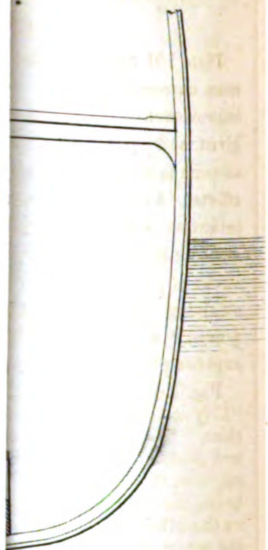


Fig. 8.

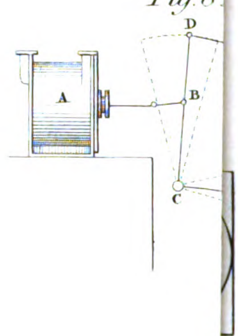


Fig. 2.

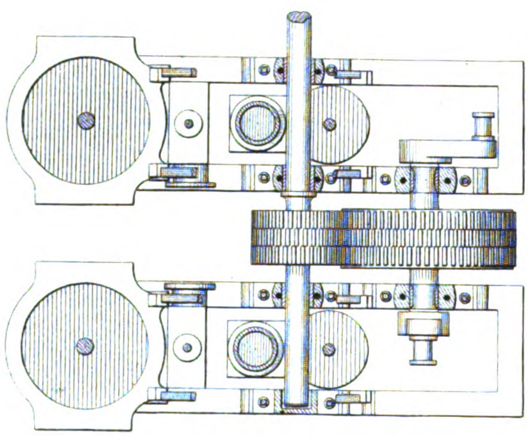


Fig. 20.

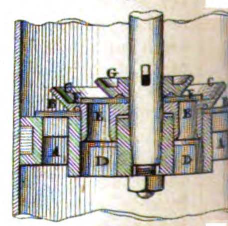
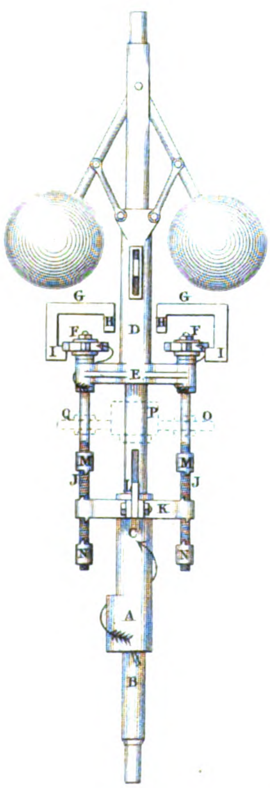


Fig. 11.



Fig

Fig. 21.

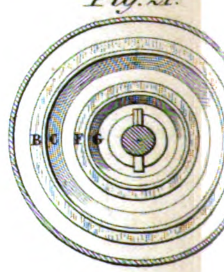


Fig. 12.

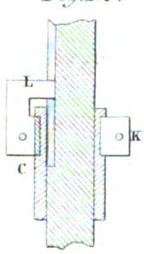
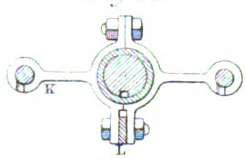


Fig. 13.



Fi

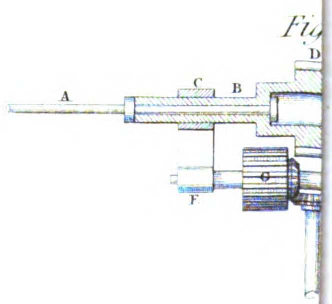


Fig. 22.

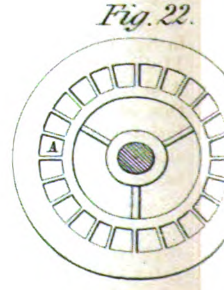


Fig. 14.

W. Johnson. Patent Offices. London. Glasgow & Edinburgh.

Eng.d by H. A.

WHITELAW'S STEAM-ENGINE IMPROVEMENTS.

(*Illustrated by Plate* 101.)

Plate 101 brings with it the redemption of our promise to discuss more narrowly the last of the long list of Mr. Whitelaw's mechanical improvements. The heads of these improvements we have already given, and our return to them now for a full investigation, may be taken as some indication of the value which we place upon Mr. Whitelaw's efforts. As a short recapitulation of the essential objects of the present invention, we may remind our readers, that it comprehends an arrangement for securing the advantages of a long-stroked engine, with a short stroke of piston, without the sacrifice of any good feature on either side, obtaining greater uniformity of speed in expansion engines, an improved "secondary action" governor, a balanced slide-valve, and a superior plan of air-pump buckets and valves.

Fig. 1 on our plate 101, is a transverse section of the screw steamer "City of Glasgow," showing a side elevation of one of her engines complete. Fig. 2 is a corresponding plan of the cylinders, foundation plate, and gearing of both engines, showing the space they occupy. In these engines, the main centre is placed midway in the length of the working beam, the steam cylinders being on one side of the ship, and the cranks on the other, whilst the motion is communicated from the crank-shaft to the screw-shaft, by a spur-wheel and pinion. The distinction between this kind of engine, and one form of Mr. Whitelaw's engine, is to be explained in reference to figs. 3 and 4. Fig. 3 is a transverse section of a vessel, similar in all respects to that represented in fig. 1, but showing an elevation of the improved engine. Fig. 4 is a plan, showing the actual horizontal space taken up by a pair of such engines. In this arrangement, the cylinders, A, are placed one on each side of the vessel, and the piston-rod of each engine is connected by links to the end, B, of the working beam. This beam, in place of being set to work upon a centre equidistant from each end of the beam, as in fig. 1, is carried on the main centre, C, placed considerably nearer to the centre line of the cylinder than to the connecting-rod centre, or pin. In this way the engine has a short stroke, and therefore admits of being worked at such correspondingly high speed, as may be required to drive the shaft, D, of the screw propeller, directly, or without spur-wheels, or other intermediate gearing; at the same time that the reduced pressure on the crank and its increased length, give to this engine most of the advantages of one of the ordinary kind, having a length of stroke even greater than that corresponding to the length of crank in the new engine. In addition to these important points, the engine is cheaper in construction, lighter, and occupies less room than the ordinary engine. In this kind of engine, the cylinders, instead of being placed, one on each side of the vessel, so as to balance each other, as shown in fig. 4, may be set side by side, or arranged in a similar way to that in which the cylinders of the engines shown in fig. 2 are placed. Indeed, the engine in fig. 3 is represented the same as it would be if the cylinders were arranged according to the plan last mentioned. The link, or strap, which connects one crank-pin to the other of the engines shown in fig. 4. is represented by dotted lines in that figure.

The practical advantages of the new arrangement of short-stroked engines over the old form may be arrived at, considering the following results calculated by the formula for the modulus of the crank, given near the top of page 370 of *Moseley's Engineering*. Although this formula does not apply to every example, it will yet suit our purpose.

The diameter of each of the steam cylinders, shown in figs. 1, 2, 3, and 4, is 64 inches. In figs. 1 and 2, the stroke is 5 feet—the length of crank being 30 inches; whilst in figs. 3 and 4 the stroke is 30, and the length of crank 23·81 inches.

Taking the mean pressure on the piston = 18 lbs. per square inch, the journals of the wrought-iron crank-shaft of the steam-engine shown in fig. 1 must be 12·55 inches diameter, or radius = 6·275 inches, and 11·43 will be the diameter, or 5·715 inches the radius of the crank-pin. And if 7° 10′ = the limiting angle of resistance to friction, the sine of this = ·1248, and the work done by the connecting-rod during one revolution of the engine being represented by 100, the work which the crank-shaft will perform in the same time will, by the formula above referred to, be =

$$100 - 157{\cdot}1 \times {\cdot}1248 \left(\frac{6{\cdot}275 + 5{\cdot}715}{30}\right) = 92{\cdot}16;$$

that is, if 100 represent the power or work the connecting-rod communicates to the crank-pin, the crank-shaft will not give out a greater amount of work than is represented by the number 92·16, or nearly 8 per cent. of the power imparted by the connecting-rod is lost by friction on the crank-shaft and crank-pin bearings.

The crank-shaft journals of the steam-engine, shown in fig. 3, will be less in diameter than the journals of the crank-shaft of the engine represented in fig. 1—the length of stroke of the former being but half that of the latter; and as the connecting-rod end of the working beam of the engine, shown in fig. 3, is so much longer than its cylinder end, as to give a crank of 23·81 in place of 15 inches, the pressure on the crank-pin, and consequently the diameter of that pin, will be less in this engine than it is in the other. Calculating by the same rules that were used in the last example, and the pressure of steam on the piston being 18 lbs. per square inch, the same as before, the diameter of the crank-shaft journals, and the radius of those journals of the engine shown in fig. 3 respectively, are 9·96 and 4·98 inches, and the diameter of the crank-pin of this engine is 9·074, or radius = 4·537 inches. Here the formula becomes

$$100 - 157{\cdot}1 \times {\cdot}1248 \left(\frac{4{\cdot}98 + 4{\cdot}537}{23{\cdot}81}\right) = 92{\cdot}16;$$

or the coefficient, which represents the efficiency or power transmitted from the connecting-rod to the crank-shaft, is the same in this as in the last example.

If the connecting-rod end of the working beam of the steam-engine, shown in fig. 3, were twice the length of the end next the cylinder, the radius of the crank-shaft journals would be 4·98, radius of crank-pin 4·043 inches, and length of crank 30 inches. And

$$100 - 157{\cdot}1 \times {\cdot}1248 \left(\frac{4{\cdot}98 + 4{\cdot}043}{30}\right) = 94{\cdot}103,$$

which is 2 per cent. above the results already obtained.

If the kind of steam-engine, represented in fig. 1, had a stroke of $2\frac{1}{2}$ in place of 5 feet, the coefficient which represents the work the crank-shaft is capable of exerting would be 85·06, or 15 per cent. of the whole power transmitted by the connecting-rod would be required to overcome the friction on the crank-pin and crank-shaft. Hence the efficiency is 9 per cent. less than it is in the new engine with the same length of stroke and a crank of 30 inches, as is shown by this and by the last example.

The power required to overcome the friction of the large pair of spur-wheels, which, on account of their diameters being small and the pitch of the teeth great, will not be less than that necessary to overcome the friction on the crank-pin and crank-shaft of the engine, shown in fig. 1, being also taken into consideration, it will be evident that the advantage, so far as efficiency is concerned, is greatly in favour of the new engine. The last calculated result given above, shows that the old kind of engine, if made with a stroke so short as to give the crank-shaft the required speed, cannot be used to advantage; and it will also be evident that the arrangement, shown in fig. 1, is no improvement on this, if the disadvantages connected with the use of the large pair of spur-wheels be taken into account, as they must be.

Having stated the advantages proposed to be obtained by the new arrangement of engine for driving screw propellers or other machinery requiring high speed, we proceed to describe a few of its modifications.

Fig. 5 is a transverse section of a ship, similar to the sections shown in figs. 1 and 3, but fitted with a pair of engines of another kind. Fig. 6 is a plan of the base or foundation of the engines corresponding, showing the double crank-shaft in position. Fig. 7 is a plan of the upper portion of the engines, in which the top of the framing, main centre bearings, main centres, the working beams, and the air pump levers are shown. The steam cylinders, A, are placed one on each side of the vessel, and the cross head of each piston-rod is connected by links with the short ends, B, of its pair of working beams, which oscillate on the main centre, C. The opposite longer ends, D, of the two pairs of working beams, are jointed to four separate connecting-rods, which pass downwards to the two cranks on the screw-shaft, E, where each pair of rods is jointed to a separate crank, one rod end on each side of the engine being single, or plain, and the other double, or forked. The side plates of the beams, G, are set at a greater distance asunder than in the case of the other pair of beams, H, in order that the latter may work through, or between the side plates of the former, as shown in the plan, fig. 7. In this way, each side set of beams is made to work within a space not much greater than that ordinarily occupied by a single beam. The corresponding beams, G and H, of each pair, are fast on the ends of the transverse main centres or rocking shafts, F, passing from side to side, and carrying levers, I, which may work the air-pumps, placed, as shown at J, in fig. 6. This arrangement of the engines affords great advantages in economising space, whilst the cylinders and air-pumps are made to balance exactly on each side of the keel line.

Fig. 8 is a diagram of a horizontal cylinder engine, arranged to work

so as to secure the advantages of the differential, or unequally divided beam. The cylinder, A, has its piston-rod connected by a link at B, nearly at the middle of the length of a lever, or beam, C D, which works on a fixed centre at C. In this way, the end, D, of the beam, by having a traverse of about double that of the piston, actuates the long crank, E, by means of the connecting-rod, F. The other end of the beam may be made available for actuating a pump, by an extending arm or lever, G.

On referring back to fig. 3, it will be obvious that, if the slide valve were placed either on one side or behind, instead of in front of the cylinder, as therein represented, the cylinder might be placed much lower down, and this would admit of the working beam being also lowered, provided a sufficiently long connecting-rod could still be obtained. Fig. 9 is a diagram of a pair of vertical cylinder engines, with working beams brought very close down towards the crank-shaft. The cylinders, A, are fitted up on the "trunk" principle, that is, with hollow trunks, or rods, B, attached to the upper sides of the pistons, and working through stuffing-boxes in the cylinder covers, like the ordinary piston-rods. The pistons are jointed, as shown at C, to the lower ends of links, D, which work inside of the trunks, B, and are jointed by their upper ends at E, to the short ends of the working beams, carried on main centres at F. The opposite long ends of these beams are jointed at G, to the lower ends of the links, or short lengths of connecting-rods, H, which are again connected by joints at I, to the upper ends of the main lengths, J, of the connecting-rods. The latter, passing downwards, are jointed at their lower ends to their respective crank-pins, K, of the main shaft, L. In this instance, the short links, H, add, in reality, so much more effective length to the main connecting-rods, J. In other terms, the effective length of the connecting-rods is equal to the whole length, from G, at the extremity of the long end of the working beam, to K, at the crank-pin. The upper ends of the links, H, are not guided in a vertical direction, but each beam is made to act as a guide to the connecting-rod of the other, by means of the rocking levers, M, fastened on the main centre, or side of the working beam. The upper ends of those levers are jointed to links, N, the opposite ends of which are similarly connected at I, to the joints in the connecting-rods, G, I, K. By this means, the action of each beam guides the connecting-rod of the opposite beam, retaining the centres, I, at the proper effective angle for working; that is, the centres, I, are so guided as to work nearly in the same curve, through which points at this distance from the upper end, measured along a straight inflexible rod of the length, G, I, K, would work, so as to give the jointed rod the full working advantage of a straight inflexible rod of about the same length. The rods, O, depending from the working beams may work air or other pumps. The working beams may be brought as close, or closer to the cylinder cover, by causing the cylinders to oscillate slightly on trunnions in the usual way, the piston-rods being jointed directly to the beam ends.

Fig. 10 is a diagram of a Woolf's, or double cylinder expansive engine, arranged according to these improvements. In this plan, A is the main centre of the working beam, on each side of which centre, and at suitable distances asunder, are placed the small or high pressure cylinder, B, and larger or low pressure cylinder, C, their respective piston-rods being connected to the main beam at D and E. From the end, F, of the working beam, the connecting-rod descends to the crank-pin, G, below. It is obvious that, by this arrangement, the united effect of the pressure of the steam on the two short-stroke pistons is made to act upon a long crank, as in the plans before described. The action of the pressure of the steam on each piston is also balanced on each side, the main centre. The steam ways, communicating between the cylinders, are straighter than in the ordinary Woolf's engine, inasmuch as the steam from the upper end of the small cylinder, passes directly into the corresponding upper end of the large one; and similarly, the exhaust at the opposite ends is from the lower port of the small cylinder to the corresponding port of the larger one; and one cylinder being placed near the other, the connecting steam passages are shorter than they are in other engines of this class. The arrangement, shown in fig. 10, may be modified by transposing the relative positions of large and small cylinders; the small cylinder being placed on the connecting-rod side of the main centre.

Mr. Whitelaw secures superior uniformity of motion to the crank-shaft of engines working to a high degree of expansion, by so proportioning certain of the moving parts, that the inertia arising therefrom may assist in producing greater uniformity in the power actually applied from the steam cylinder to the crank-pin, by equalizing the variable pressure due to the gradual expansion of the steam in the cylinder. In other terms, it is proposed to proportion the weight of certain of the moving parts to the initial pressure of the steam, and the degree of expansion, so that the extra steam pressure at the early part of the stroke shall be applied in producing an amount of momentum in those moving parts, which momentum will be given out or expended in assisting the exertions of the attenuated steam at a later period of the stroke. By this means the effect of the varying steam pressure is made to give a more uniform actuating pressure to the crank-pin, than in the ordinary expansive engine. As an example of the effect of this system of working, we may refer to fig. 8, representing a horizontal cylinder engine, where, if the piston and other moveable parts through which the piston's motion is conveyed to the crank-pin were very light, the pressure on the crank-pin would vary nearly to the same extent as that of the steam in the cylinder. But if the weight of the piston is increased to such an extent that it will take an amount of pressure, about equal to the excess of the initial over the mean pressure in the cylinder, to keep up the velocity of the piston, and the moveable parts which transmit its motion to the crank-pin, to the extent required, during the time the crank makes, say one-fourth of a revolution from either of its dead points, or from its position at the time the piston is at either end of the cylinder; and if, in this position of the crank, the steam has just reached its mean pressure, it is evident that, as the whole of the excess above the mean pressure has been spent in imparting motion to the piston and the parts conveying the motion of the latter to the crank-pin, that pin, as well as the crank-shaft, must have been actuated during the time by a uniform, or nearly uniform force, equal to that due to the mean steam pressure in the cylinder. The principle of this system, then, is to cause the initial excess of steam pressure over the mean pressure at the early portion of the stroke, to communicate to certain of the moving parts of the engine their full amount of momentum; and afterwards, when this excess ceases or becomes negative, to cause the momentum so given, to assist in turning the crank to the extent which shall maintain a uniform or nearly uniform pressure on the crank-pin throughout its entire revolution. Under such a system the strength of certain parts of the engine may be diminished, whilst its motion is made nearly as uniform as that of a non-expansive engine. In vertical cylinder engines, as in fig. 3, wherein the force applied to the working beam should always be in equilibrium on each side the main centre, it may be advisable, in cases where additional weight is required to increase the inertia, to place part of the added weight on the piston, or on the cylinder end of the beam, and part on the connecting-rod.

Fig. 11 is a complete side elevation of one of the many forms or modifications of Mr. Whitelaw's governor, with its regulating mechanism attached. Fig. 12 is a vertical section through a portion of the governor spindle, and part of the slide mechanism. Fig. 13 is a horizontal section of the spindle, with a plan of the lower sliding cross-head. Fig. 14 is a plan of the expansion cam; and fig. 15 is a diagram, representing the pair of adjusting star-wheels with two of their fixed detents. Figs. 12 to 15 are drawn to a larger scale than fig. 11. The cam, A, for working the expansion valve, is carried round by a spiral feather, B, on the lower end of the governor spindle, and has a long boss, C, fitting loosely to the spindle, and passing upwards for connection with the pendulum action above. Then, as the pendulum balls expand with the increased rate of the engine, they draw the cam upwards, thus traversing it along its spiral feather, B, and setting it forward to cut off the steam earlier. Similarly, the pendulum action brings down the cam again, as the balls contract, on the diminution of the engine's speed, and thus the cam is set back. In this way the upward or downward traverse of the sliding tube, D, of the governor causes the cam, A, to be set forward or back, as the case may be, on its spindle, thus altering the extent of expansion. The lower end of the tubular slide, D, which fits loosely on the upright spindle, and is linked in the usual way to the pendulous arms above, is formed with a cross head, E, having an eye at each end bored out to receive the vertical spindles of the star-wheels, F, which are carried round with the governor spindle. On the two fixed brackets, G, set on opposite sides of the governor spindle, are fixed two sets of stationary pins or teeth, H and I, each pair being in the same plane; and when the engine is working at its proper rate, the star-wheels, F, revolve with the spindle of the governor at such a height as to work clear of the fixed teeth, H and I; but should the engine increase its speed, the interior portions of the peripheries of the star-wheels, F, will come in contact with the inner and higher pair of pins, H. When this occurs, the revolution of the star-wheels with the governor spindle will cause them to turn upon their own individual axes, and if the governor revolves, as indicated by the arrow in fig. 11, this action will also cause the star-wheels to turn in the direction indicated by the arrows upon them. If, on the other hand, the engine's speed should decrease, with the governor spindle still going in the same direction, then the exterior part of the periphery of the star-wheels will similarly come in contact with the outer pins, I, of the brackets, G, as represented in the diagram, fig. 15, when the star-wheels will be turned in the op-

posite direction, as pointed out by the arrows in that figure. These two opposite actions, then, of the star-wheels are made available for securing an additional power or secondary action for regulating the speed of the engine through its expansion valves, by means of the vertical spindles, J, on the upper ends of which the star-wheels are fast; these spindles are screwed at their lower ends, and are passed through screwed eyes in the cross head, K, attached to the upper end of the boss of the cam, A. This cross head fits loosely in a ring groove in the cam-boss, and carries a side projecting piece, L, which works into a short groove in the governor spindle, and this serves as a vertical guide for the cross head during its traverse up or down, whilst the cam-boss works round within its collar. Similarly, the vertical traverse of the tubular slide, D, of the governor is insured by a cotter or flat stud passed through the governor spindle, projecting on each side through a vertical slot in the slide.

By the adoption of this arrangement, as the expansion cam, A, has a partial turn communicated to it in either direction, by the upward or downward traverse of the governor-slide, D, the star-wheels, F, also get a partial revolution correspondingly, as they come in contact with one or other of the two pairs of fixed pins, H, I; and thus, what is termed a secondary action is given to the cam, setting it still further forward or backward, by the revolution of the screwed spindles, J, through the eyes of the cross head, K. And this additional action will go on until the arrival of the engine at its true rate of working shall bring the star-wheels, F, between and clear of the fixed teeth, H, I. By this means, if the engine is exposed to varying degrees of resistance, this additional movement will give it a great nicety of adjustment, and bring it to work at a uniform rate, which would not take place if it were unfurnished with such secondary action.

By a slight addition to the mechanism, provision is made for the prevention of the accidental turning of the spindles of the wheels, F, too far in either direction. The wheels are attached to their spindles by stiff friction, and the eyes of the cross head, K, are furnished with inclined teeth or detents on each side, corresponding to similar teeth, set in reverse directions on the lower and upper sides of the upper and lower collars, M, N, fast on the spindles. Thus, when the spindles have turned to the full extent allotted to them in either direction, these catches will come into action, and prevent further movement; whilst the stiff friction connection of the wheels on their spindles will allow the wheels themselves to turn or move free when brought in contact with the fixed teeth, H, I. By a slight modification of the arrangement, one of the star-wheels may be dispensed with, a spur pinion being placed on one of the spindles, as at O, to gear with the loose pinion, P, on the governor spindle, which pinion again gears with the third pinion, Q, fast on the opposite star-wheel spindle. In this way, the revolution of one star-wheel spindle is communicated to the other, to give both a simultaneous movement, whilst one star-wheel only is used. Or the three pinions, O, P, Q, may still be used, even with two star-wheels, in order to insure the simultaneous movement of the two spindles, in case one star-wheel should at any time come into action before the other. Instead of having merely two pairs of fixed pins, H, I, three or more pairs may be used, and set at different heights, in order that, when the engine's rate is only slightly faster or slower than it ought to be, the secondary action may come into play with greater delicacy. The same effect may also be produced by two pairs of pins, as shown in fig. 11.

In engines working at a high velocity, where it might be injudicious to work the governor spindle at the rate necessary for the ordinary single cam, as in fig. 14, the governor may be reduced in speed, if fitted with a cam made double or triple, to correspond to this reduction in the rate. Or, instead of having the cam upon the governor spindle itself, it may be carried on a separate spindle, working in connection with the engine; and if adapted to that spindle in the same way as the cam, A, is connected to the governor spindle in fig. 11, the cam may be moved backwards or forwards as required, by means of a lever or other connection with the governor. And the secondary action may also in this case be applied, so that the cam, if placed on a separate spindle, may be made to regulate the speed to as great a degree of nicety as if it were placed on the governor spindle, and it may be adapted as well to work an eccentric or a tapering cam or other apparatus, such as "Field's valve," where the cam is simply traversed along in the direction of the axis of the spindle on which it is carried.

Fig. 16 represents the plan adopted for giving a secondary action to the ordinary throttle valves of steam-engines. The rod, A, is supposed to be connected to the ordinary governor action, and its end is attached by a revolving joint to one end of the tubular piece, B, arranged to revolve when necessary in bearings in the brackets, C, and having a spur pinion, D, formed on its centre. At the opposite end of the tubular piece, B, is attached the rod, E, leading to the throttle valve—this rod being screwed into the end of the tubular piece. The same brackets, C, also afford supports, F, for a short spindle, having upon it two loose spur pinions, G. At H is a constantly revolving spindle, carrying a small bevel pinion on its extremity in gear with the pair of bevel pinions, one of which is attached to each of the loose pinions, G. Then, as the pendulous action of the governor traverses the rod, A, in either direction, if traversed far enough it brings the pinion, D, into gear with one or other of the pinions, G, which constantly revolve in contrary directions. When this occurs, the pinion, D, and tubular piece, B, are driven round so as to screw back or forward the end of the rod, E, and thus give a secondary action to the throttle valve. This may obviously be made to regulate the action of various kinds of valves, and especially the contrivance known as "Rowan's fluctuating slider."

Fig. 17 is a longitudinal section of a single cup-valve, valve-chest, and steam-ports of an engine, to which Mr. Whitelaw's plan of balancing the steam pressure is applied. Fig. 18 is a transverse section of the same parts corresponding. The slide valve, A, has a groove, B, formed along a portion of the two parallel face flanges, which run in the direction of the valve's travel. These grooves correspond to similar grooves or recesses, formed, as shown in the cylinder face, on which the slide works—such recesses having side or lateral openings in connection with the tubes, C, which communicate with a force-pump or reservoir for keeping up an internal fluid pressure within the recesses in the cylinder and valve faces. By this means the upward pressure beneath the valve may be made to balance that of the downward steam pressure, and thus ease the frictional working of the valve. Should the upward pressure be at any time so great as to tend to elevate the valve from its working face, provision may be made for keeping it down by wedge side-plates, D, adjustable on the two angles of the side flanges. Fig. 19 exhibits a simple form of pump or pressure apparatus, which may be employed for keeping up the balancing fluid pressure. A, is a small cylinder, fitted with a piston, which is acted on from above by a link jointed to a lever, working on a fixed centre, B, and weighted at its free end by the weight, C. This cylinder opens at its bottom end into a horizontal pipe, one side, D, of which communicates with the fluid reservoir, and has a clack-valve opening towards the cylinder. The other end, E, of this pipe has a clack-valve opening from the cylinder, and is made to communicate with the tubes, C, delineated in fig. 18. When in use, the pressure of the weighted piston on the fluid in the cylinder beneath it, keeps up a constant fluid pressure beneath the engine slide-valve to the extent required. When, however, from leakage or other cause, the piston descends any, even the slightest, distance towards the bottom of this cylinder, the tappet, F, on the continual working rod, G, will give the lever a lift, thus elevating the piston in its cylinder, and causing the inlet valve of the pipe, D, to admit a further fluid supply. This will be continually repeated as often as any escape takes place, the traversing tappet giving occasional slight lifts to the piston for the restoration of the fluid pressure. To insure constant action, two pumps should be used, in order that one may be always furnishing the necessary pressure.

Fig. 20 is a vertical section of a cylinder or air-pump barrel, fitted with Mr. Whitelaw's improved bucket, also shown in section. Fig. 21 is a horizontal or transverse section of the pump barrel, showing the bucket in plan within it. Fig. 22 is a plan of the bucket. Fig. 23 is a plan of the second story or seat of the bucket-valve detached; and fig. 24 is a plan of the upper guard for the smaller annular valve or upper story. The bucket, which is packed in the usual way, has first of all an exterior large annular water-way through it, as at A, strengthened and connected to the inner portion by radial web pieces. This water-way is covered over by a flexible or elastic ring or annular valve, B, forming the lower story, or lift. This valve is held, or secured, by its inner edge down on its seat by the binding pressure of the second story piece, C, which acts as a guard to keep the valve from rising too high, whilst it has also a cylindrical collar or projection fitting into the upper portion of the second story annular water-way, D, similar to, but smaller, than the lower one, A. This piece has also an annular thoroughfare, E, in correspondence with the water-way beneath it, and this is covered by the elastic annular valve, F, which is held down by the upper guard, G. This upper guard is kept in position by a cotter passed transversely through the bucket rod, and thus binds both valves and guards securely down. Such a bucket acts much quicker than the ordinary kind, and with far less concussion, whilst it affords a clear water-way, and brings the rising fluid column nearer to the centre of the pump than can be accomplished in the usual way.

The results contained in the following table, show that the new engine is equally well suited for land or stationary uses, or those to which the long-stroked steam-engine is usually applied, as it is for screw propellers or other like purposes. Results were calculated by the same formulæ or rules formerly used; the diameter of the steam cylinder was

taken at 3 feet, and the mean pressure on the piston at 18 lbs. per square inch.

TABLE.

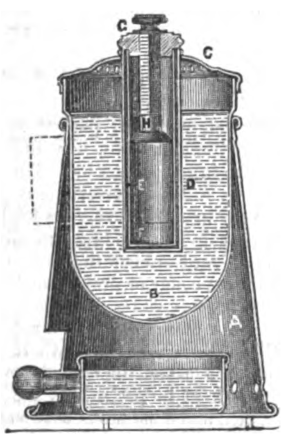
No.	Length of stroke in feet.	Length of crank in inches.	Coefficient of effect.
1	7·50	45·00	96·467
2	6·00	36·00	95·775
3	3·00	18·00	92·570
4	3·75	45·00	97·318
5	3·75	35·71	96·467
6	3·00	36·00	96.798
7	3·00	28·57	95·774
1	2	3	4

In this table, numbers 1, 2, and 3 give the results for the old, and the other numbers are for the new kind of steam-engine. From the 2nd column it will be seen, that the new engine must be much cheaper, and the speed of its crank-shaft very high as compared with the old. The 4th being the highest result contained in the last column of the table, places the new engine, in respect to efficiency, in a favourable light.

The new steam-engine, if it did nothing more than render heavy and, in many cases, complicated intermediate gearing unnecessary, should recommend itself.

BOLAND'S ALEUROMETER FOR DETERMINING THE PANIFIABLE VALUE OF FLOUR.

If the taunting remark—that the great object of an Englishman's life is to produce a yard of cloth at a lower rate than anybody else—has any weight, it ought not to be confined to the textile branches of his business. If he does make such a boast, at least give him credit for the occupancy of a sphere somewhat larger in extent, and accord him his place as the most expert and energetic changer of the forms of nature's masses. It is true that his efforts for securing cheapness occasionally run him into carelessness as to the quality of his wares; but such errors find their own remedy, and he is too acute to neglect doing exactly what is wanted. Whether it is that fine flour is not so much in demand with us as in France, we know not; but it is certain that our millers lose something in their hurry to produce large quantities. The French miller, aided by his favourable atmosphere, takes more pains with his business. Adopting a slower, more careful, and expensive process, he produces the best flour in the world; and his successor, the baker, is equally mindful that his raw material shall lose no good quality at his hands in being converted into bread. Hence French flour and French bread constantly preserve their fair reputation as the best productions of their class. M. Boland's *aleurometer* is another instance of the extreme care of our continental neighbours. This little instrument has been contrived to determine the panifiable properties, or the breadmaking value of flour, by ascertaining the elasticity of its gluten, or that quality by means of which the paste rises under the influence of the products of fermentation. Our engraving delineates the apparatus in vertical section. It is of great simplicity, consisting of an external case, A, slightly conical, open at the top, to receive the inner vessel, B, the rounded bottom of which is heated by a spirit lamp from below. This inner vessel is filled with neat's foot oil, to a level with the top of the external case, and is closed by a cover, C, from the centre of which hangs downwards a cylindrical case, D, dipping into the oil. This case contains the indicating apparatus—a thermometer graduated to 200°, with divisions of 50° engraved on glass, being used in conjunction with it. Within the case, D, is a second cylinder, E, closed at the bottom by a screwed cap, F, its top being similarly covered in by a screw-plug, G, through the centre of which is passed a vertical tube, H, graduated to divisions of 25°, but having an ungraduated portion at its lower end, equal in length to the depth of the plug, G. Beneath this ungraduated portion the tube terminates in a small disc, filling up the bore of the vessel, E, leaving an empty space beneath it, equal to 25° of the graduations on the tube, as indicated by the dotted line. This form of construction is the one suited for purely scientific purposes: for the commercial operations of the baker



it is placed in the oven to heat it, so that the outer heating-case is then no longer required.

In using it, a paste is made of 30 parts by weight of flour, and 15 of water, kneaded in the hand of the operator, and dipped from time to time in water. The starch is then washed out of it, by kneading under a stream of water, leaving pure gluten. A ball is then made of seven grammes of the gluten, and rolled in powdered starch, to prevent sticking, and the cylinder, E, being slightly greased, the ball is passed down it into the recess at the bottom. Previous to this, the spirit-lamp must have heated the apparatus until a thermometer, placed within the tube, E, stands at 150°, and the aleurometer is then put in its place. After this the spirit-lamp is permitted to burn ten minutes longer; it is then put out, and at the end of another ten minutes the gluten is taken out, the number of degrees indicated by the elevation of the rod, H, being duly noted. This rising of the rod is due to the expansion of the gluten, which necessarily rises and solidifies, taking the form of the interior of the aleurometer. Should the expansion be so slight as not to bring up the top of the gluten to the disc of the rod, H, that is, if it does not reach 25° of dilatation, it may be safely concluded that the flour whence the gluten has been obtained is totally unfit for making into bread.

M. Boland furnishes various examples of tests by this apparatus. Thus, in flour from Etampes, producing 33 per cent. of hydrated gluten, the dilatation was 29°. Again, in wheat from Berg, with 30 per cent. of gluten, the dilatation was 39°; and in another sample of the same kind, with 32 per cent. of gluten, the aleurometer revealed an expansion of 50°. Gluten from a starchmaker's, dried and ground coarsely, gave 38°; and the same, ground fine, gave 50°. It thus appears that the gluten of the starchmaker, extracted by washing, and properly dried and ground, preserves its panifiable qualities in perfection.

MM. Payen and Chevreul have both reported favourably of the value of this invention, in their lectures in the School of Medicine, and the Conservatoire des Arts et Métiers.

OUTLINES OF GEOLOGY.

III.

FOSSILIFEROUS ROCKS.

The stratified portion of the earth's crust is of different thickness in different places. So far as observation has yet gone, it varies from three to ten miles. The superficial extent of these rocks is about two-thirds of that of the land at present raised above the sea. These may be classed under three heads, according to their mineral composition, being generally either sandstone, limestone, or clay.

Sandstone is nothing but aggregated sand hardened into stone, and variously coloured by different matters. The principal constituent of all sands is silex, a mineral which, under the form of flint or quartz, every one is acquainted with. The grains in some cases have been made to cohere simply by pressure; in others, by the infiltration of carbonate of lime, or by the interposition of fine particles of clay, oxide of iron, &c. Some sandstones are laminar, that is, they are capable of being separated into thin layers; others exhibit no inclination to split in one direction rather than in another; they may be worked freely in any direction, and hence are termed freestone. Gritstone is a common name for coarse sandstones. Generally sandstones possess little tenacity, and soon give way under the influence of the weather.

Limestone is a term applied to a great variety of rocks which contain, as their principal constituent, carbonate of calcium or lime. Statuary marble and chalk are nearly pure carbonates of lime. Dolomite contains carbonate of magnesia, intermixed with carbonate of lime. The Houses of Parliament are built of dolomite. The texture and colour of limestones are very various. One kind is called oolite, from being composed of small egg-shaped particles, compared to the roe of fish. When minutely examined, it is seen to be formed of calcareous matter, collected in concentric layers round a small portion of mineral, or often a minute fragment of organic matter. Marbles are of crystalline texture, and are the effect of heat on earthy calcareous rock. Calcareous rocks are probably for the most part of organic origin, being formed from the debris of shells and corals, the material for which was extracted from sea-water by marine animals. It is calculated that the total weight of carbonate of lime in solution in sea-water is about 400 billions of tons; or two millions of tons in each square mile, allowing a mean depth of 1000 feet. By the admixture of siliceous or argillaceous matter, limestone gradually passes into sandstone or shale. Many of the English limestones take a good polish, and are known as Purbeck, Derbyshire, or Westmoreland marbles, most of which are remarkable for the sections of fossils they contain.

Clay.—That which gives clay its peculiar plastic character, the earth

alumina—usually in the form of a silicate—is mixed with many other substances, giving it various colours and degrees of consistency. When clay has been subjected to pressure in the earth's interior, and the moisture dissipated, it becomes shale, schist, or slate, which differ in little else but texture and density. All were at first in the condition of very fine mud or silt, deposited layer upon layer by water, and afterwards made to cohere by pressure. The cleavable structure which slate rocks frequently possess, and which allows them to be split into laminæ in a direction transverse to the stratification, is supposed to result from some fresh arrangement of the particles or small masses of the rock; some new molecular constitution of their substance consequent upon a general agency, such as heat, which released the parts from their original bonds; and upon some general and determinate affinity, such as electricity, which gave particular directions to the planes of their reunion. This structure is analogous to crystallization. Fine roofing slates are obtained by splitting the rock along the cleavage planes, and not along planes parallel to the stratification; whilst certain flagstones and laminated sandy limestones, which are also frequently used for roofing, are obtained by splitting the rock parallel to these latter planes.

Various rocks are composed, not simply of sand, lime, or clay, but of intimate mixtures of them all, or of any two; such are arenaceous or argillaceous limestones, compounds of lime and silex or clay; calcareous or arenaceous slates, compounds of clay and lime or silex. These rocks have frequently names of local origin; such are cornbrash, graywacke, rag, and gault.

Marl is a mixture of lime and clay; loam, of sand and clay.

The word *fossil* originally meant something *dug* out of the earth. It is now used as nearly synonymous with evidence of organic life, whether vegetable or animal, in ancient rocks. This evidence may be of all degrees of completeness, from a mere trace, such as the footmark of an animal, to a nearly entire tree or perfect skeleton.

With respect to vegetables, the following varieties of fossils have been found:—1. Impressions of the exterior, the original substance having disappeared, as in the case of ferns in the strata of sand and clay above and below the coal. 2. The vegetable substance carbonized or converted into coal. 3. The vegetable converted into mineral matter (such as silex, carbonate of lime, or pyrites), so that a facsimile of the organic original is presented by inorganic materials. Such facsimiles are usually termed petrifactions. It would seem that, as one particle of the original substance was removed, a foreign particle took its place before a second particle gave way. Silicified woods sometimes afford beautiful examples of such petrifactions. 4. Sometimes the plant is found so little altered, that its tissues are distinct, and it retains much of its original elasticity. With respect to animals, a very curious kind of evidence consists of footprints and *rails*, such as are not uncommon in certain sand rocks, where thin layers of tenacious marl alternate with hard and fine sandstone. Footmarks of tortoises have been found in new red sandstone in Dumfriesshire; footmarks, eight or ten inches long, probably of an opossum, in Saxony; footmarks of gigantic birds, twice the size of an ostrich, in Connecticut valley, United States; marks of feet, armed with claws, resembling those of an alligator, with marks of the animal's tail, in old red sandstone, in Pennsylvania. In other places, worm casts, trails of crabs, starfishes, and other sand animals, have been discovered. Equally curious instances of the preservation of minute occurrences, to all appearance essentially evanescent, are afforded in the case of dimples made by falling rain, and marks of rippling water on what was once soft sand, but since converted into hard rock. Shells are the most abundant forms of animal remains. In some cases the impression of the external surface only is left, at other times of the internal, and occasionally the space between the inside and outside packing, having been left vacant by the destruction of the shell, it has subsequently been filled up by another substance, which accurately represents both the exterior and interior form of the shell. In some cases the form of the softer parts of animals is preserved by the process of petrifaction above described. Such are the silicified sponges, which occur in limestones and other rocks. The most perfect remains of organic life are shells or bones which have been worn, discoloured, or otherwise altered by long exposure, but preserve a part of the original matter. Of this kind are the masses of coral which make up the greater part of the calcareous rocks beneath the coal measures, and the shells of foraminifera, which compose the greater part of some cretaceous rocks; and of the same character are the siliceous cases or skeletons of certain animalcules, which occur in such extreme numbers, that although each is only visible to a good microscope, the whole form deposits sometimes sixty feet in thickness, and of considerable extent. The cases of starfishes and echini, the bones, teeth, and scales of fishes, the skeletons of reptiles, of birds, and of quadrupeds, come under this head.

To sum up the description of those masses which, under the name of fossiliferous strata, occur, as far as we at present know, in all parts of the globe, we may say that they are generally composed of sands, clays, and limestones, with marls and loams interspersed; that they are known to extend in some places to a depth of ten miles, and are sometimes found on the highest spots on the surface of the globe. That the evidence of the existence of organic life occurs through the whole mass of these rocks, and sometimes to the degree, that immense masses of rock, forming hills of the extent for instance of the chalk of Great Britain, are formed almost entirely of their remains.

Such being the geologist's materials, the problem he has to solve is to arrange the whole in successive order, so as to show what was the appearance of the whole earth at any given period. The principal question is, the relative quantity and position of land and sea; but the question of climate, of the kind of animal and vegetable life at different periods, and the order of creation, arise in the course of his investigations, and may in a great measure be solved by the evidence which he disinters.

An attempt to form a general classification of rocks, is necessarily founded on many local classifications. We must always bear in mind how small a part of the world has yet been thoroughly investigated by the geologist. Northern Europe, and part of North America, include all that can be so considered; and even in these parts much remains to be done, in order to connect one locality with another. In what follows we shall take British deposits as the basis of classification, and refer to such foreign beds only as have been connected with this local classification. These deposits will be treated of under three epochs—

1. Palæozoic, embracing fossiliferous strata, from their commencement in Great Britain to the end of the permian or magnesian limestone system.
2. Secondary, being from the end of that system to the end of the cretaceous system.
3. Tertiary, from the end of the cretaceous system to the present time.

Palæozoic Epoch.

In the following table, the various groups of the Palæozoic epoch in Great Britain, and their principal foreign equivalents, are arranged in the order of their succession downwards:—

Permian or Magnesian Limestone System.

British.	Foreign.
1. Magnesian Limestone Series— *a* Grey thin bedded limestone. *b* Red marl and gypsum. *c* Magnesian limestone and conglomerate.	Zechstein, consisting of clay beds (*Letten*), bituminous fetid limestone (*Stinkstein*), and cellular magnesian limestone (*Rauwacke*), Schistose beds, argillaceous and arenaceous, separated by a bituminous band (*Kupfer schiefer*). In Franconia, the Hartz mountains and the Thuringian forest; also in the North of France.
2. Lower New Red Sandstone Series— *a* Marly slates, with thin beds of impure limestone. *b* Lower new red sandstone.	*Rothe-todte-liegende* of Germany. Round the Vosges Mountains of France.

Carboniferous System.

1. Coal Measures— *a* Gritstones. *b* True coal measures. *c* Freshwater limestone of Burdie House, near Edinburgh.	Important in Belgium, France, (terrain carbonifere), the Rhine, (Stein Hohlen gebirge), South Russia, North America, Asia, and Australia.
2. Millstone grit— *a* Coarse gritstones. *b* Laminated shales.	Of small importance out of the British islands.
3. Carboniferous limestone— *a* Bands of fossiliferous limestones. *b* Shales.	Kiesel-Schiefer, Germany, Belgian limestone beds, and others in Northern Bavaria.

Old Red Sandstone System.

S. Wales.	Devon & Cornwall.	Continental.
Quartzose conglomerates. Cornstone & marl.	Coarse red flagstones and slates. Calcareous slate, limestone, sandy beds, and conglomerates.	Well known in Belgium, the Eifel, Westphalia, and North Bavaria; also in Russia. The palæozoic beds of Australia are supposed to be cotemporaneous.

Silurian System.

Highest (formerly Upper) Series— 1. Tilestone, a quartzose sandstone, quarried for tiles. 2. Ludlow group. Upper shales, beds of fine yellow micaceous sandstone, argillo-calcareous stone, and argillaceous rock, called mudstone. Aymestry limestone, bluish-grey, subcrystalline, and highly fossiliferous. Lower shales, grey argillaceous beds, with concretions of clayey limestone, shales, or mudstones.	Largely developed in Northern Europe, and in corresponding latitudes of America. In Brittany, Westphalia, near Constantinople, and in Asia Minor, cotemporaneous rocks in South Africa, the southernmost parts of South America, Australia, and China—mineral characters generally distinct from British beds; no marked characters in common.
3. Wenlock or Dudley group. Wenlock limestone, beds or concretions of argillaceous limestone, separated by beds of shales, highly fossiliferous. Wenlock shales, grey argillaceous beds.	In the North of England, the upper Silurian series is thought to be represented by the upper part of the highest division of slate rocks of the lake district; the Caradoc limestone and Llandeilo flags, by the the lower part of that division, and the

Middle (formerly Lower) Series—	
1. Caradoc limestone, sandstones with calcareous bands, fossiliferous.	Coniston limestone. In the south of Scotland (Ayrshire), there are equivalents of the Wenlock shale, and the Caradoc and Llandeilo beds.
2. Llandeilo flags, sandy or gritty beds, furnishing flagstones.	
Lowest Series—	
Cambrian slaty strata, fossiliferous almost to their base.	This, the lowest zone of organic life, has no equivalent in the south of Scotland, unless it be partly represented by Sedgwick's group of greywacke slate, and sandstone, and Moffat group. It is, however, developed in Scandinavia and Bohemia.
Cambrian slaty strata, Scawfell slate (middle group,) Skiddaw slate (lowest group). Fossils only recently discovered.	

The Silurian system is made up of beds of sandstone, limestone, and slate, most of which are more or less laminated. The whole forms a series of vast thickness, and has received particular attention, from its being the depository of the earliest forms of organic life.

It was first elucidated in that part of the Welsh border (counties of Radnor, Hereford, and Salop), formerly inhabited by the Siluri, and hence its name. But since Murchison's elaboration of it from that locality, where the Llandeilo beds form its base, strata many thousand feet in thickness have been found in other parts of Wales, which contain middle (formerly lower) Silurian fossils. For these strata, Sedgwick proposed the name of Cambrian system, but Murchison makes them part of his Silurian system, forming into a lowest series those beds which are not equivalents of Caradoc and Llandeilo rocks. The name of Cambrian rocks was formerly given by Sedgwick to the two lower groups of Cumberland slates. No fossils having been found, he attributed to them an older date than the oldest of the Cambrian series; but since the discovery of fossils, they are classed with the Cambrian strata, and placed at the base of the Silurian system.

In the lower beds of this system argillaceous matter much preponderates, the limestones being of insignificant thickness. Clay, slate, and siliceous rock, form indeed almost the entire mass.

The upper part differs from the lower, in having apparently been deposited in a less disturbed sea. Coralline limestones make their appearance for the first time in these beds.

The traces of vegetable life are very obscure, but representatives of all the four divisions of animal life—vertebrata, articulata, mollusca, and radiata—have been discovered. The first is indicated by traces of fish.* Of articulated creatures, trilobites, supposed to represent a crustaceous animal, are the best examples during this period. The class mollusca is represented in all its sections. The greatest number of species belonging to cephalopoda and brachiopoda, of the lowest sub-kingdom radiata, there occur many species of crinoidea and polypifera.

A theory once prevailed, that in the early period of the world species were fewer, more universally distributed, and more simple in their organisation. It is now considered that this theory was based on insufficient data. In the first place, remains of animal precede in time those of vegetable life. Scarcely a trace of vegetable life occurs in the Silurian period, though remains of fish have survived. Again, among animal forms a greater number of species occur of the higher than lower forms. Thus, mollusca are more abundant than radiata; and of the mollusca, the most abundant forms, cephalopoda and brachiopoda, are the one the most, and the other not the least organised of their class. What appears to be true is, that we find as highly developed organisms in the ancient marine strata as we find now in the ocean. We do not indeed find the higher vertebrata, neither do we find remains of vegetation; and perhaps for the same reason, that they are inhabitants chiefly of the land; and if land existed at the time of the deposition of the oldest strata with which we are acquainted, and it was inhabited by the higher vertebrata, and covered by vegetation, still there would be no causes in action which would embed these forms of life generally in those deposits in process of formation beneath the sea. They might be carried by rivers and floods into the sea, and perhaps such local deposits may be hereafter discovered. But it may be that no dry land existed during this period.

Old Red Sandstone System.

This system, which consists of limestone, marl, and sandstone strata, alternating with conglomerate, often passing into sandstone, has been chiefly studied in South Wales and Devonshire. The strata in the two localities, though presenting no similarity of mineral or mechanical conditions, are identified by their fossils, and can be connected by means of equivalent beds in the north of Ireland and the south of Scotland, where there are complete series. It is believed that the Devon beds, formerly classed with rocks below the Silurian, but now seen to be much more recent, range cotemporaneously with the *upper part* of the Welsh beds. They underlie the culm measures (Carboniferous system), whilst the Welsh beds are connected with the upper part of the Silurian system. The Devon beds in many places have a metamorphic character, and in these, the traces of organic life, elsewhere abundant, have been obliterated. A belt of old red sandstone strata surrounds the English lake district, and rises at Mell Fell to a height of 1000 feet above the sea. The Scotch beds have been identified with those of Herefordshire and South Wales, and the Belgian series with that of Devonshire, as shown in the following table:—

Devonshire.	Belgium.
Calcareous grits and impure limestone.	Indurated shale and psammite.
Red flagstones.	Lower limestone.
Calcareous slates, Plymouth limestone, coarse arenaceous beds in North Devon, and general series of Cornish rocks—all fossiliferous.	Hard siliceous beds and conglomerates.
Herefordshire and South Wales.	**Scotland.**
Conglomerate of white quartz pebbles in red matrix (quartzose sandstone), alternating with mottled marls.	Quartzose yellow sandstone. Impure limestone. Gritty red sandstone. (Fife and Moray.)
Cornstone (impure concretionary limestone).	Grey fissile sandstone. (Forfar and Moray.)
Argillaceous marly beds, alternating with sandstone or cornstone.	Red and variegated sandstones. Bituminous schists. Coarse gritty sandstone. Great conglomerate. (Caithness, rising to a height of 3,500 feet.)

It is remarkable, that organic remains are not to be found in large tracts of old red sandstone, a peculiarity which appears to belong not to the age, but to the mineral character of the formation, for paucity of such remains is remarked wherever deposits of similar red sand occur. In parts of the old red sandstone, however, the remains of fish occur in abundance—above sixty species having been described. In the Devonian rocks, remains of crustacea, mollusca, and zoophytes, occur abundantly. The brachiopoda are, as in the Silurian system, a prevailing group.

* Traces of a four-footed animal, supposed by Professor Owen to have been left by a reptile, in lower Silurian strata, have recently been found by Mr. Logan in the course of his geological survey of Canada.

KENNEDY'S REACTION BALANCE WATER-METER.

(*Illustrated by Plate* 102.)

To measure water correctly, and at a cost commensurate with the low intrinsic value of the article, has been a difficult problem for practical men. Out of the many plans which the spread of artificial water-works has brought into being, we can, so far, reckon only upon two classes—those in which accuracy is sacrificed to cheapness of construction, and another equally valueless series, in which the vain attempt to attain accuracy has involved hopeless complication. The present plans, which are the invention of Mr. Thomas Kennedy, a well-known Ayrshire rifle-maker, have steered clear of both these difficulties. Mr. Kennedy secures accuracy of measurement, whilst he does not interfere to any appreciable extent with the pressure of the passing fluid; and as to the cost of his apparatus, our plate shall afford evidence. The water is contained in a neat rectangular wooden case, of which, fig. 1 is a vertical section, showing the measuring apparatus in elevation within. Fig. 2 is a vertical section of the adjustable water-valve detached, and drawn to a scale of one-fourth the real size. Fig. 3 is a corresponding section of the external cylinder of the valve, with its internal slotted water-way cylinder in external elevation. Fig. 4 is a half-size side view of the indicating mechanism, and the clockwork, or continual mover, as detached from the valve.

The leading feature of the invention consists in the so connecting an adjustable valve, or water-way, with an arrangement of clockwork, or other uniform continual mover, that the quicker or slower rate of flow, or the greater or less supply of water passing through the water-way, shall be at all times indicated by variable apparatus worked from the continual mover, or rather actuated by the combined motion of the continual mover, and the variable portion of the adjustable valve itself. In the example which we have represented, the whole apparatus is contained within the rectangular wooden case, A, closed on all sides, and fitted with a cover-lid, B, which may be opened, as shown in fig. 1, for examination of the state of the index. The lower portion of this case contains the adjustable valve, C, the external cylinder of which is secured to the side of the case by short stud pillars, or brackets, having their ends passed through the wood, and secured outside by the nuts, D; over this, near the top of the case, is a shelf, or platform, E, to act as a support for the clockwork, F, with the indicating mechanism, G, surmounting it. Any species of continual mover may be used, but in the present instance it is an ordinary clock, actuated by the weight, H, hung from the first motion barrel, I, and driving a train of wheels, terminating at the opposite end in a crown escapement, J, working the pallet spindle, K, carrying a four-armed balance wheel, L. At M is an additional wheel in gear with the third wheel, N, of the train. It is fast on the upper end of the inclined shaft, P, arranged for connecting the clock movement with the indicating apparatus. The shaft, P, is sup-

Plate 102

WATER-METER.

T. KENNEDY, PATENTEE,

KILMARNOCK.

Fig. 1.

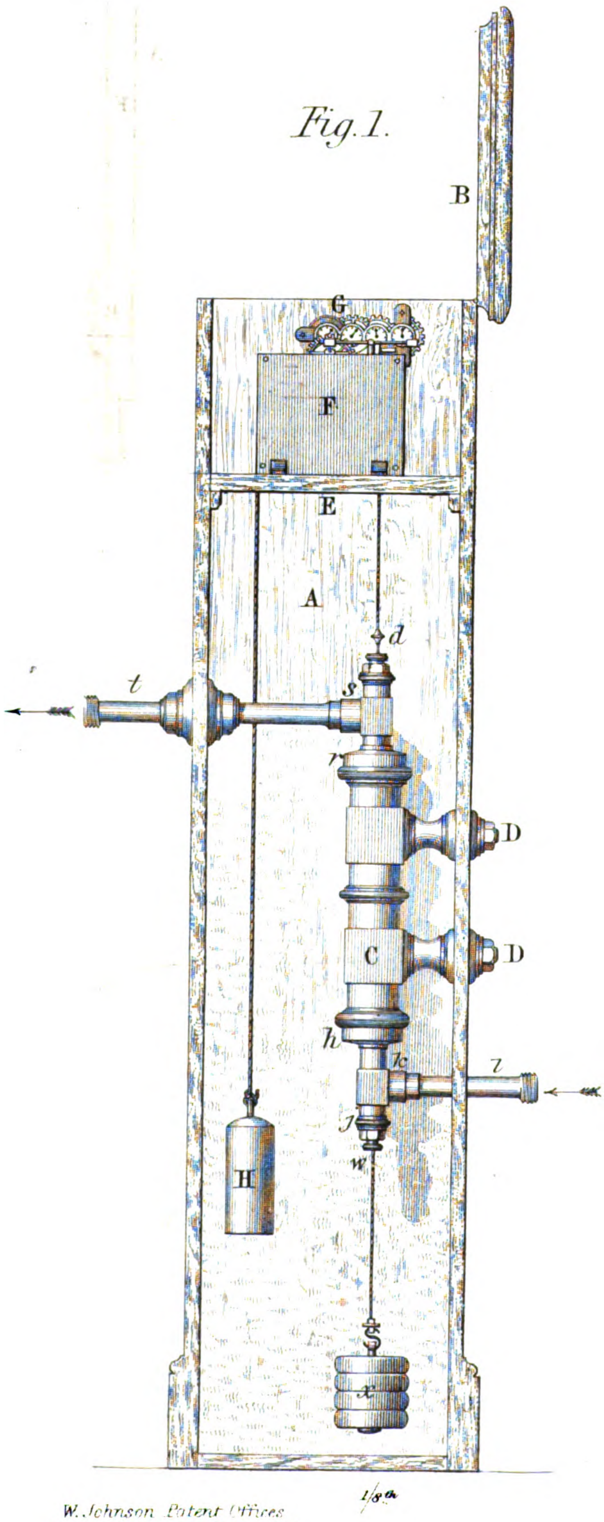
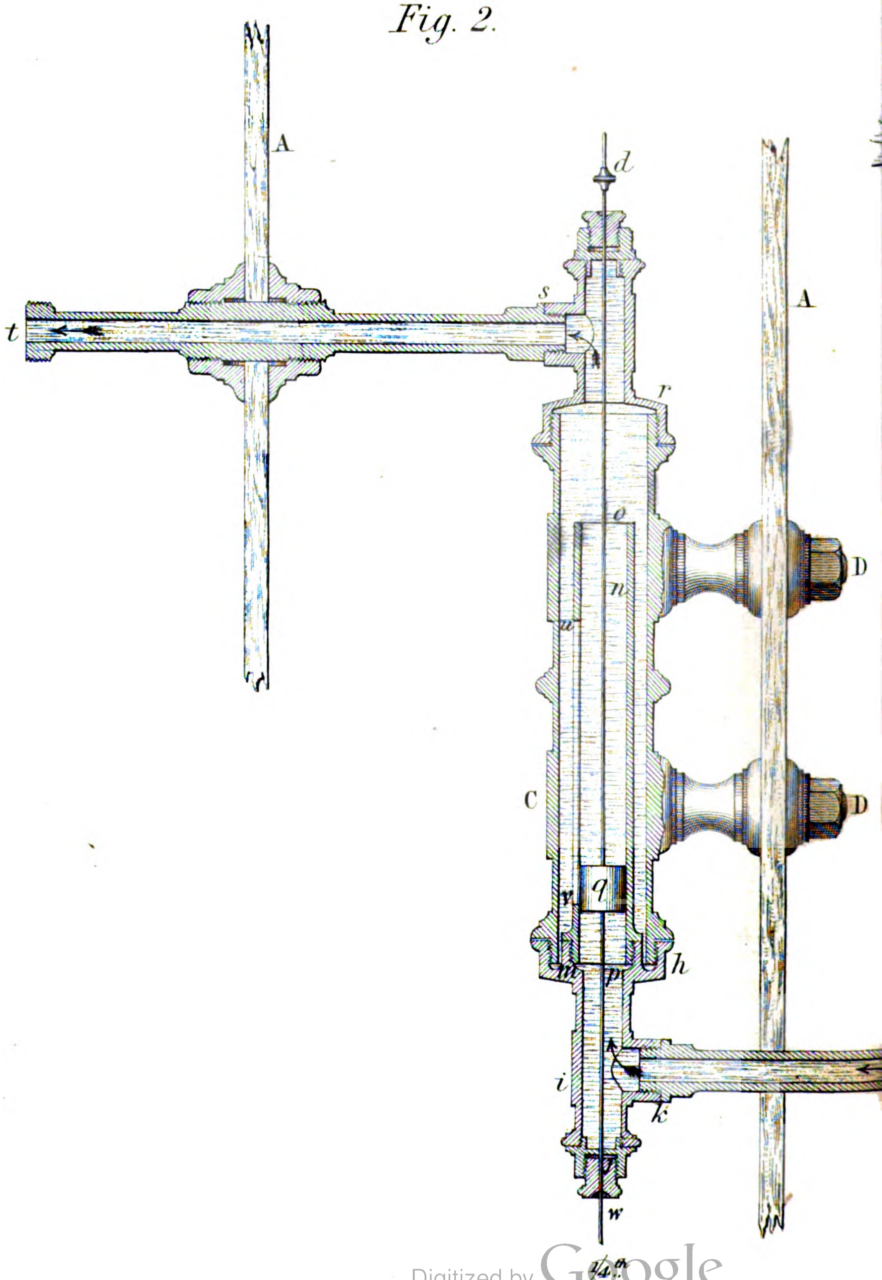


Fig. 2.



W. Johnson Patent Offices
London, Glasgow & Edinburgh

Fig. 4.

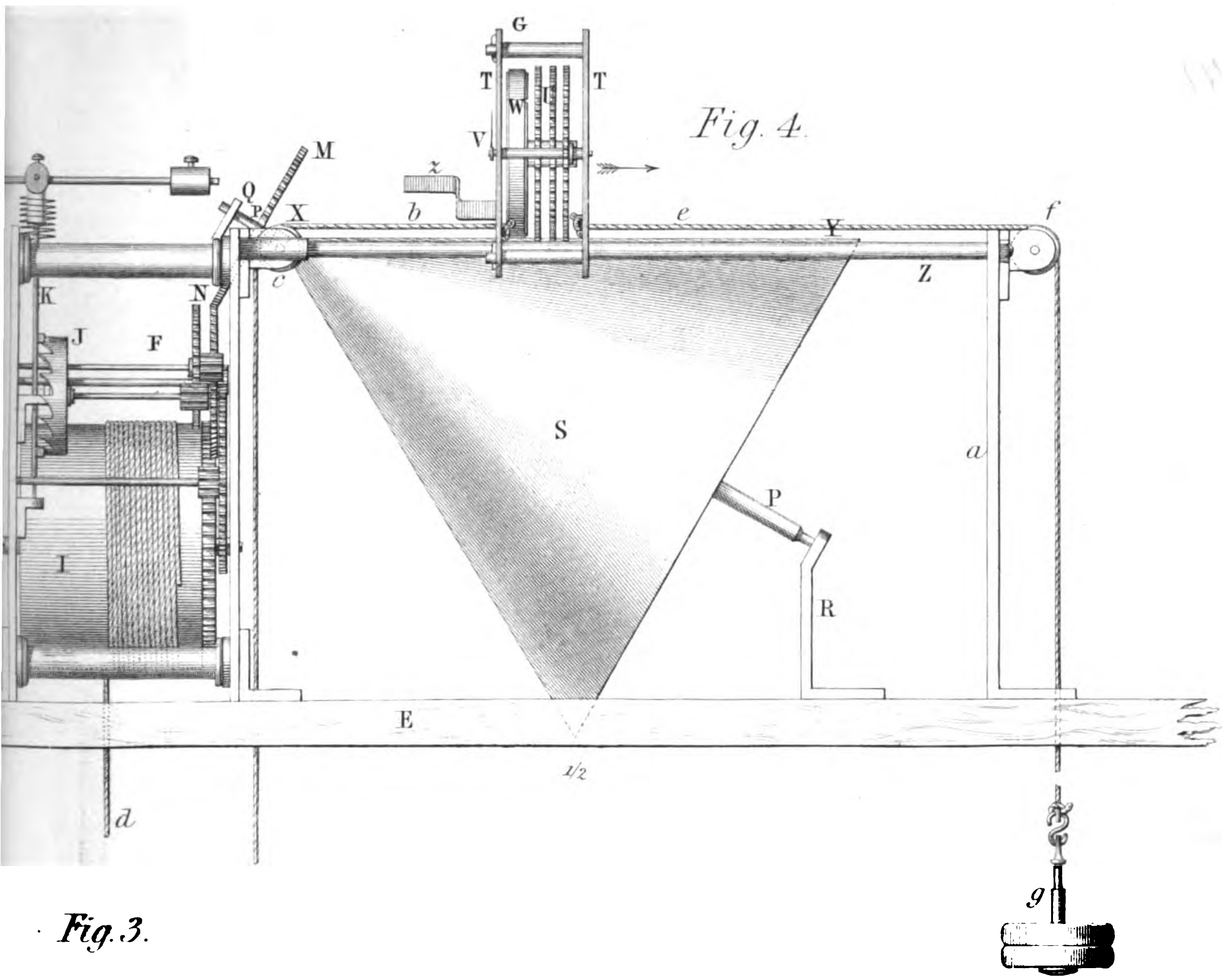


Fig. 5.

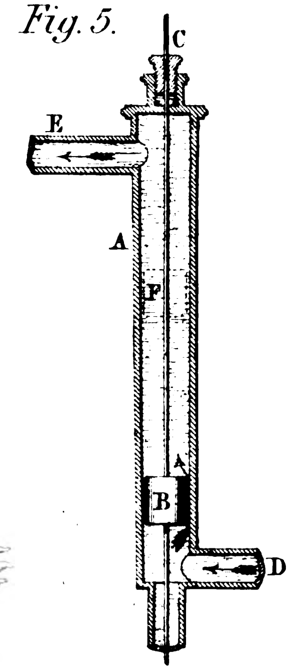


Fig. 3.

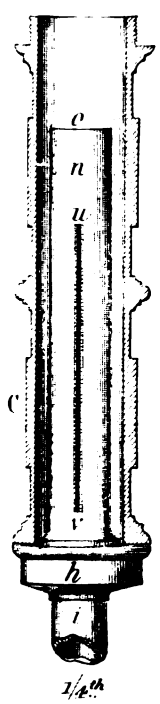


Fig. 6.

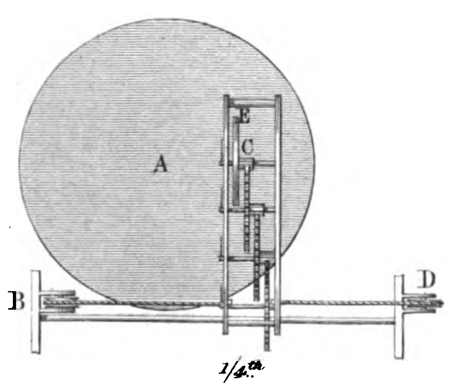
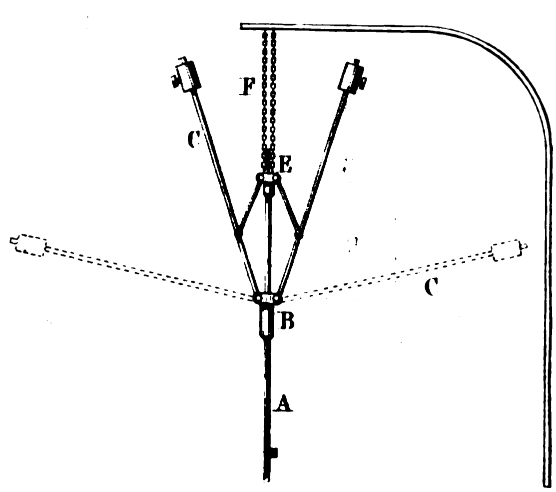


Fig. 7.



Eng.d by G. Aikman E.

ported in an upper bearing, Q, on the clock framing, and in a lower bracket, R, standing up from the platform, E, and carries a large conical drum, S, the longitudinal section of which is of the form of an equilateral triangle; that is to say, its base, or the end of the drum, coincides in diameter with the surface length from the base to the apex. It is so set on an inclined spindle, that its upper acting surface shall be in a horizontal line for the convenient traverse upon it of the indicating apparatus. This apparatus is contained within the two side frame plates, T, T, stayed in the usual way, and containing a train of wheels, U, the spindles of which work indices, V, graduated to indicate from 1 to 100,000 gallons, just as a gas-meter indicator points out the cubic feet of gas. The first motion of this index consists of a pulley or surface friction wheel, W, the spindle of which carries a pinion for driving the entire train. This pulley rests by its periphery upon the horizontal line surface of the cone, S, the whole indicating apparatus being capable of traversing longitudinally along this line, that is, from X to Y, being guided in a straight line by a fixed rod, Z, supported at one end by the back plate of the clock framing, and at the other by a standard, *a*, this rod, Z, being passed through both the plates, T. On one side, the frame, T, of this traversing index has attached to it a cord, *b*, passing over a fixed guide pulley, *c*, and thence downwards through the platform to the adjustable valve beneath, where it is connected at *d* to the valve spindle. On the opposite side of the index frame is a similar cord, *e*, passing over a fixed guide pulley, *f*, and having a counter-weight, *g*, attached to its extreme end.

The adjustable valve consists of an external cylinder, C, to the lower open end of which is screwed a cap piece, *h*, cast in one piece with the tubular piece, *i*, which terminates in a stuffing-box, *j*. The pipe, *i*, has a side branch, *k*, to which is screwed the end of the supplying pipe, *l*, passing out through the side of the containing case. The cap, *h*, has an inner screwed collar, *m*, to receive an internal bored cylinder, *n*, open at both ends, *o*, *p*, and accurately fitted with a delicately moving piston, *q*. The upper end of the external cylinder is covered over by a screwed cap, *r*, the upper tubular portion of which is surmounted by a stuffing-box, just as at the bottom of the cylinder. A side branch, *s*, forms the outlet for the water, conducting it into the discharge pipe, *t*, passed through and attached to the wooden case. The inner bored cylinder, *n*, is slotted through one side longitudinally, nearly from end to end, as from *u* to *v*; the slot, as shown in the vertical section, figure 3, being cut square for a short distance from the interior surface, after which it is expanded or beveled off outwards, so as to afford the best chance for the escape of any foreign matters in the water. The piston, *q*, which works nicely within the cylinder, is fast upon the spindle, *d*, *w*, passing through the upper and lower stuffing-boxes of the external cylinder, its upper end being attached to the cord of the indicating apparatus as before described, whilst a weight, *x*, is hung to its lower extremity. When fitted up for use, the pipe, *l*, communicates with the water main, or reservoir, whilst the pipe, *t*, above, is similarly connected with the discharge cock, by which the water is drawn off. The fluid current follows the course of the arrows, the water passing in from the pipe, *i*, up into the internal cylinder, *n*, by its open lower end; there it is met by the piston, *q*, which, at the commencement of the supply of water, stands at the bottom of its cylinder, where the slot terminates. The hydrostatic pressure then elevates the piston in the cylinder, until a portion of the length of the slot in the latter is laid open to the water, when the latter finds its way through the opening into the external cylinder, C, whence it flows off between the inner and outer cylinders, and through the branch, *s*, to the discharge pipe, *t*. The effect of this rise of the piston, which must always take place before the least quantity of water can pass through the valve, is, that the pulley, W, and indicating apparatus, is traversed from the small end of the cone, S, at which point the pulley, W, always stands, when the piston, *q*, is at the bottom of its stroke a corresponding distance towards the large end, or greatest diameter of the cone. This traverse is effected by the slackening of the cord, *b*, when the piston rises, permitting the counter-weight, *g*, to exert its power in drawing down its cord, *e*, and thus traverse the indicating apparatus in the direction of the arrow. When the piston again falls, from the diminution of the effective or unbalanced elevating hydrostatic pressure beneath it, then the larger weight, *x*, which is hung to the valve spindle, overcomes the weight, *g*, and brings down the piston, retraversing the indicating apparatus towards the smaller end of the cone. In this way, the driving friction pulley, W, of the indicator, is constantly regulated or adjusted in its position on the cone, in accordance with the precise amount of elevation of the valve piston; that is, when the piston exposes the entire length of the cylinder slot to the passage of the water, the indicator stands on the largest end of the cone, gradually approaching the small end of the latter, as the piston descends to cover up its slot. When the piston reaches the bottom of its stroke, the indicator is likewise at the end of its traverse towards the small end of the cone, and the stop arm, *z*, then comes in contact with the balance, L, and stops the clock, there being no office for it to fulfil when no water is passing through the valve.

Then as the cone is constantly caused to revolve at a uniform rate during the action of the meter, by the action of the clock, as already described, it follows that the friction pulley, W, will be driven by the cone at a gradually increasing or diminishing rate, accordingly as it approaches the large or small end of the cone, and thus the dial indications must always coincide with the exact quantity of water passing, or the rate of flow through the meter, whether that quantity is great or small. The weight, *y*, hung to the rod, *n*, of the piston, is sufficient to keep the piston firmly down upon the rising fluid column at 1, in the inner cylinder, in addition to traversing the indicator, whilst it moves freely up or down, in obedience to the effect of the unbalanced columnar pressure beneath the piston. The traverse of the piston in its cylinder is accurately proportioned to the rate of increase of the cone's diameter, so that a certain determined length of the slot or water-way, which is known to discharge a certain quantity of water at a given effective pressure beneath the piston, shall accurately coincide with the relative position of the indicator upon the cone, and the consequent relative dial indications; and although the head pressure or the columnar height of the water from which the supply is taken and passed into the meter may vary, such variation will in nowise interfere with the accuracy of the measurements of the apparatus, for it is the amount of effective or unbalanced pressure beneath the piston which governs the extent of elevation of the piston and the resultant dial indications, and this elevation depends not upon the hydrostatic pressure in the main, but upon the extent of opening of the service-cock, which allows the water to pass through the meter. Thus, when this discharge-cock is closed, the fluid pressure beneath the piston is completely balanced or annihilated, from the effect of the reacting pressure of the water upon the upper side of the piston, which reaction occurs from the communication existing between the upper side of the piston and the head pressure through the annular passage between the outer and inner cylinders, and the open top of the latter. Under such conditions the piston falls to the bottom of its cylinder, and the indicator, as a necessary consequence, ceases to act. Then, when the service-cock is opened, the greater or less fluid-discharge through it removes more or less of the reacting pressure from the upper side of the piston, and hence the latter is subjected to a greater or less effective pressure beneath it, and it consequently rises in proportion to such effective pressure. Hence it is that the indications of the quantities of the passing fluid can be made to agree with the actual discharge of the fluid, whether that discharge is regular or irregular, quick or slow, the effective pressure of the fluid and the amount of opening of the discharge-cock at any given moment being pointed out by the position of the actuating wheel of the indicator on the cone, whilst the constant mover or clock indicates the precise increment of time during which each such pressure or opening is in use. After the water has passed through the adjustable valve, it may be conducted very nearly to the height practically due to the supplying head of water, the only loss of pressure being a small amount occasioned by the slight load upon the piston, which load is necessary to keep the piston firmly down upon the water beneath it.

Fig. 5 is a vertical section of another valve which may be employed. It consists of a conical barrel or chamber, A, having within it a conical piston or plunger, B, the diameter of which is such as to fit the smallest end of the barrel. This piston is carried on a vertical rod, C, passing through each end of the barrel, and connected to an indicating apparatus in the manner hereinbefore described. The water is supplied to the meter by the lower branch, D, and is discharged therefrom by the upper passage, E. When the piston is at the bottom of its travel, it fits accurately to the small end of its barrel, and prevents the passage of any water; but as it rises, the water escapes all round it, through the annular space between the outside of the piston and the interior of the barrel. The higher the piston is elevated, the wider is this annular space, as indicated by the dotted position of the piston at F; and it is therefore made to indicate the increased flow, by acting upon the index mechanism in the manner hereinbefore described.

Fig. 6 exhibits a detail of another arrangement, whereby the state of the adjustable valve and the consequent flow of the water may be indicated and registered. This figure is a plan of another modification of indicating apparatus, to be worked in connection with the clock or continual mover, instead of the cone, S, a horizontal disc, A, being substituted for the cone. This disc is carried upon the upper end of a vertical spindle, driven by the clock movement at a uniform rate. At B is the pulley over which the cord from the adjustable valve passes up to the indicator, C; and at D is a second pulley, over which the counter-

weight cord is hung. The index train is made precisely the same as that hereinbefore described, its actuating friction-pulley, E, being set to rest upon the upper plain surface of the disc, A. Then, as the rise or fall of the piston traverses the indicator, nearer to or further from the periphery of the disc, the dial indications show a greater or less rate; that is, when the valve is closed, the pulley, E, is immediately above the centre of motion of the disc, and consequently receives no motion, and, on the other hand, when the pulley is at the edge of the disc, it indicates the full opening of the valve.

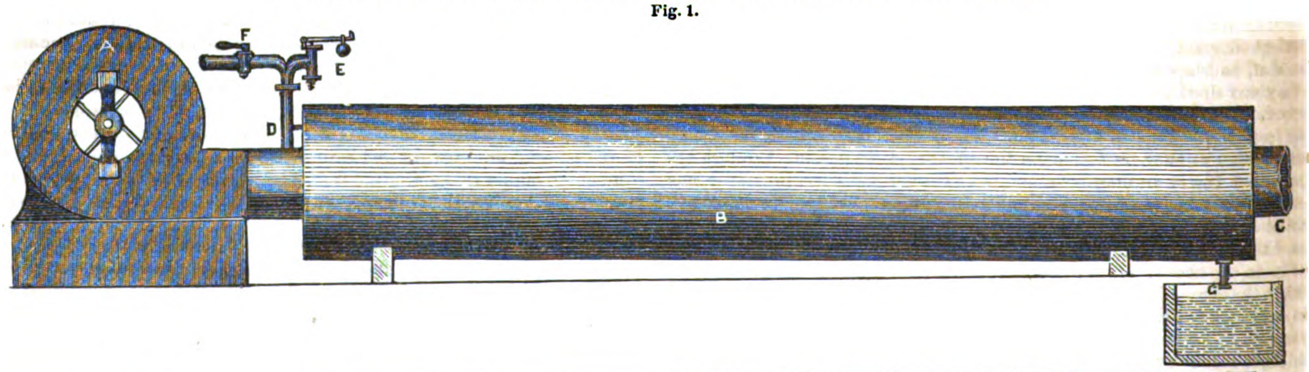
Fig. 7 exhibits a side elevation of an adjustable balance or pendulum action as fitted to the pallet-spindle of the clock, and involving another modification of arrangements for indicating the action of the adjustable water-valve and the resultant flow of water. In this instance the valve is made to adjust the clock's rate of going, so that, instead of being a continuous uniform mover, it goes quicker or slower in obedience to the position of the piston in its cylinder, the quantity of water passed through the meter being read off from the dial indications of the clock itself, which indicates a greater or less quantity accordingly as it may have been driven at a quick or slow rate for a greater or less period. In the view, fig. 7, A is the pallet-spindle, having fast upon it a boss, B, with an eye at each side, to which eyes are jointed the ends of the two pendulous arms or levers, C, having adjustable weights at their opposite ends. Each of these arms is connected by a short link-piece to a sliding collar, E, on the upper end of the pallet-spindle, the arrangement being precisely the same as an ordinary steam-engine governor reversed. The collar, E, is connected in any suitable manner to the adjustable valve action, as, for instance, by a couple of cords shown passing upwards from the collar, E. When in action, the elevation of the piston draws up the collar, E, so as to bring the arms, C, towards the vertical line, as delineated in the figure; thus in effect reducing their effective leverage or pendulous action, or, in other terms, diminishing the effective diameter of the balance, and increasing the clock's rate. Again, when the piston falls, the arms approach the horizontal line as dotted, thus increasing the effective diameter of the balance, and reducing the clock's rate. With such an arrangement, the positions of the piston in its cylinder are to be carefully set to correspond with the different angles of the balance arms, so that, when the indications are adjusted to correspond accurately with a given position of the valve, all other positions and indications may similarly correspond. Various modifications of this system of rendering the clock-movement variable as an indicator of the flow of water may be adopted; as, for example, the valve may be made to act on the balance-spring, and thus cause the clock's rate to vary with the position of the piston, or the valve may act upon a modification of the common pendulum to vary its beats.

It is obvious that Mr. Kennedy's very ingenious meter, or modifications of it, may be employed for measuring and registering the flow of various liquids as well as gases, or any aeriform bodies, the principle of action being in all cases the same.

Many modifications may be devised for carrying out this principle of fluid measurement; and since our drawings were made, Mr. Kennedy has produced a second arrangement, wherein the apparatus takes the form of an elegant pillar. It is improved as well in many of its working details—the lower stuffing-box of the measuring cylinder being done away with, by continuing the tube, *i*, downwards, to form a chamber to receive the counterweight, *x*, with its suspending wire. And to prevent any flow of water after the clock has stopped, from the running down of the weight, the latter is adjusted to close the supply-cock, as it descends to the bottom of its traverse. Again, the shield for the winding-up key of the clock is connected by a lever movement, so as to shut off the water-supply at all times, when the key is in its place. But a more important feature still is an arrangement for a self-acting winding-up action for the clock—the water itself being made to perform this important service. So compact a machine, provided, as it is, with satisfactory safeguards against tampering or fraud, must be regarded as a most useful and convenient contrivance.

HAMILTON AND WEEMS' HEATING AND VENTILATING APPARATUS.

Fig. 1.



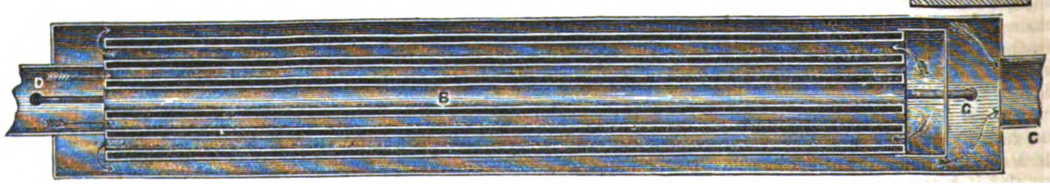


Fig. 3.

Fig. 2.

Calico-printers, bleachers, and piece-goods finishers, and, indeed, all manufacturers who have to deal with large masses of materials in a moist condition, requiring careful drying, are subject to constant annoyance from the difficulty experienced in drying their goods. Although, apparently, a very simple matter, it is by no means easy to bring the wetted goods of the bleacher to a dry state, to suit his finishing process, without involving a large expense both of time and fuel. To hasten this process, as well as to reduce its cost, is the object of Messrs. Hamilton & Weems' "improvements in warming and ventilating buildings and structures," which they have recently patented.

Our engravings represent a simple form of the apparatus which they use, as divested of the external brickwork. Fig. 1 is a side elevation, fig. 2 a horizontal section, and fig. 3 a perpendicular transverse section. By the fan, A, usually stationed outside the building, fresh, pure air is driven through and between a series of concentric annular steam-chests, B, in the direction shown by the arrows, until it is finally emitted, in a heated state, by the pipe, C. The steam-chests, B, receive the steam from the boiler, or, if a high-pressure engine exists on the premises, from its exhaust pipe, by the pipe, D, which is fitted with safety and collapse valves, E, to regulate the pressure of the steam, and a stop-cock, F, to regulate the supply. The condensed steam is carried off by the pipe, G, into a cistern, whence it may be reconveyed to the boiler. When a drying-stove is large, the heated air will be more equally distributed amongst the goods, if passed through perforated sheet-iron pipes.

In a factory, heated on Messrs. Hamilton and Weems' principle, the atmosphere is not only preserved perfectly fresh and pure at any desired temperature, but its moistness can also be regulated with the greatest nicety, simply by allowing more or less steam to mix with the air as it passes through the apparatus.

In addition to its application for drying, heating, and ventilating, in factories of almost every kind, where it has already been most extensively introduced, the patentees have put it into successful practice, for

warming and ventilating public buildings. The lunatic asylum connected with the poor-house of the Abbey parish of Paisley is so ventilated; and there, as remarked by Professor Thomson, the visiting medical officer, "a large supply of fresh and sweet air is being constantly thrown into the apartments, under circumstances that secure a perpetual renewal of their atmosphere." The authorities of the Paisley town poor-house are also about to adopt the system.

SCREW-PROPULSION.

From the day when Captain Ericcson accomplished the first successful application of the screw as a marine propeller, great numbers of screw steamers have been designed and built by various able engineers, each one doing his endeavour to improve one or other of the details of his subject, without, however, materially improving screw-propulsion on the whole. From their earliest days, screw steamers have been viewed more as vessels of heavy freight, for the conveyance of goods at moderate rates, combined with a certain degree of regularity, than for the transmission of passengers and mails. Even to my present time of writing, the public eye looks upon them in the same light. The advantages which they offer in the combination of steam power with sails, in enabling the propeller to be kept out of harm's way, and in keeping the vessel's sides clear, are indeed important points; but no one of these advantages is in the slightest degree affected by great speeds.

The secret of the non-existence of any fast screw steamer, is not to be looked for in any imaginary apathy as to getting a high speed with the screw, but in the present improper construction, bad selection and arrangement of the details, and the ill-designed combination of the whole.

Every one who has been on board a screw steamer knows that, although they manage to go at a tolerable rate in smooth water, yet in a heavy sea the screw acts badly, and most disagreeably for the passengers—proving that, somehow or other, they are very defective. It is then clear that screw-ship tactics must undergo some change; and I am glad to find the pages of the *Practical Mechanic's Journal* open for my view of the matter in question. One of your inquiring correspondents has recently put the query—"Which of the many forms of screw is the best?" And he further remarks—"their result being nearly the same, they must be either all good, or all bad." My reply to this is, that they are all good *and* all bad, according to what they are intended for, and how and where they are applied. If used merely as an auxiliary power, they are all good, or nearly so; but if intended for high rates, they are all good—for nothing. And the reason of this is, that they bear a very absurd proportion to the section of the vessel they propel, and therefore they have not the right pitch. A small screw, having a diminutive surface, requires a fine pitch. A screw of large diameter may have its pitch much coarser. The larger the screw is, the coarser the pitch may be; and the coarser the pitch is, so much the less resistance will the screw offer to the water, when disconnected for sailing under canvas. Besides, when a large diameter is used, its immersion will be less exposed to injurious variations, adding to the speed and the comfort of the passengers.

Most screw engines communicate their motion through cog-wheels, chains, and other intermediate gearing, for the acceleration of the driven shaft—a system of driving which is about as absurd as it is possible to imagine. Let us suppose a pair of engines, of a given diameter of cylinders and length of stroke, actuating a shaft with a spur-wheel upon it—the latter gearing with a pinion of half the wheel's size, to double the revolutions of the screw, allowing the steam-piston to go at a moderate speed. Now, if we made the piston's stroke half as long, and coupled it directly to the screw-shaft, the piston would still be maintained at its low rate of speed, and with the same pressure; and theoretically the same, but practically more, power would be obtained, as much friction would be saved, as well as weight, material, and space. Moreover, the diminished chance of breakage, from the smaller number of working parts, is also worth consideration. If so short a stroke, with so large a diameter, is deemed objectionable, the diameter might be decreased with an increase of the stroke, by using steam of a slightly higher pressure. For never will screw steamers furnish an instance of the requirement of so high a velocity of piston, that a corresponding steam pressure may not be generated and managed with the most perfect security, especially if the screw is large and coarse in pitch. Although every engineer of standing is well aware that high-pressure steam, worked expansively, is in every respect more economical than low-pressure, I cannot help saying a little on that point, for the very safe reason, that for all the knowledge of its value, it is so little in use for marine purposes.

The public unfortunately have got the idea, that high and low pressure steam are generated in the same kind of boilers; and, consequently, they usually fancy that the former must be much more dangerous. In support of the truth of what I am urging, I may remark, that a number of explosions on the western waters of the United States of America are reported, without affording information as to the actual causes of these catastrophes, so that they are all attributed solely to the use of high-pressure steam. If the public were acquainted with the actual causes of these casualties, and if they were possessed of information on engineering detail, and the management of marine engines, we will say, on the Ohio and Mississippi (of which I will hereafter send you a sketch), all the panic as to high pressure would at once vanish. A word more—engineers ought not to allow themselves to be guided by public opinion, if they know it to be wrong; it is their duty to form public opinion.

Many engineers believe that high-pressure steam, greatly expanded, is productive of great irregularities in the engine's rate. Now this is to some extent true with one cylinder; but with two, working at right angles, as in ordinary double marine engines, irregularities from this source are scarcely perceptible. If any one doubts this, let him calculate the pressure on each piston at a given position, multiplied by the corresponding leverage, when he will see if the variation of force is so great as he imagines. For maritime purposes, it is undoubted that here, beyond all other applications of this power, should be employed engines which offer the greatest advantages in point of space, weight, and consumption of fuel; and as the high-pressure engine has long ago proved its superiority, it is plain that we ought to adhere to the high-pressure principle. What I have now remarked, is, I presume, clear enough; but to reason upon the forms of vessels is, perhaps, not quite so easy a matter. When steam was first applied in conjunction with navigation, naval architecture was in a miserable state, having made a bare shadow of progress during several past centuries. The earliest steamers were really nothing else but full-built, slightly-lengthened, and ugly-looking sailing vessels. It was the impression of every one, that sharp vessels would not be sea-worthy; but by slowly progressive lessons, and after the consumption of much time, it was seen that sharp-built vessels behaved better at sea than full ones, leaving speed out of the question. By degrees, all steamers were built with a more or less sharp entrance, but full at the stern; a fault which was only lately ascertained, although the fact that a vessel in motion draws a mass of water after it was no mystery. It is indeed a matter of astonishment, that this pure loss of power was not sooner understood and removed, by the adoption of a finer run.

I may here state the existence of a fact, which I have never yet seen mentioned in any book or periodical,—which is, if a vessel is made sharper aft than forward, its natural course is straight ahead; but if the reverse, or sharp forward and full aft, it has a constant tendency to turn either to one side or the other. And, again, if a vessel draws more water aft, whilst it is equally sharp at both extremities, its natural course is also straight; but if, on the other hand, it draws less water aft than forward, it is scarcely manageable in fair weather, and not at all in a storm. Before making any remarks on the form to be given to screw steamers, let me first touch on the action of the screw-propeller.

From the English experiments on screw steamers, we find that, in some cases where the screw has had an incredibly small slip, the vessel did not do much in the way of speed; and, on the other hand, other ships went faster when their screws showed a large extent of slip. On the first glance this seems something extraordinary, whilst in reality nothing is more natural. Every vessel in motion draws a certain quantity of water after it, carrying forward the films nearest to its surface at the highest velocity, the tractive power diminishing gradually with the distance from the vessel's surface, until it dies away in the body of the fluid. Now, to move a cubic foot of water in a body of water, as we know, requires a certain force determinable by experiment, which lets us see that the movement of the number of cubic feet due to the immersion of a ship at a high rate, involves a very considerable expenditure of power. The screw, placed at the stern of the vessel, and therefore working in the backwater, where it has the greatest velocity, is apparently very advantageously situated. But in reality it is not favourably placed. The screw impels the vessel with a certain power, a portion of which is expended in forming a sort of vacuum behind it, producing the evil of backwater. The screw, working in an opposite direction, increases the vacuum, and absorbs a portion of the impulse given to the vessel, and increases the resistance which the screw has to overcome. This accounts in some degree for the failure in speed. The slip of the screw is not the difference between the way performed by the vessel, and the way developed by the screw; but to this difference the traverse of the backwater where the screw works, has, obviously enough, to be added, to ascertain the real slip of the screw. Now, the finer the run of a craft, the less is the volume and velocity of the backwater, and the more the apparent slip approaches the real one; and it is therefore evident, that the more we can reduce the slip of the screw, the more it proves that

the power of the engine and the action of the screw is applied to the propulsion of the vessel; consequently, that form of vessel which occasions least screw slip, is the best for speed in smooth water. With this,

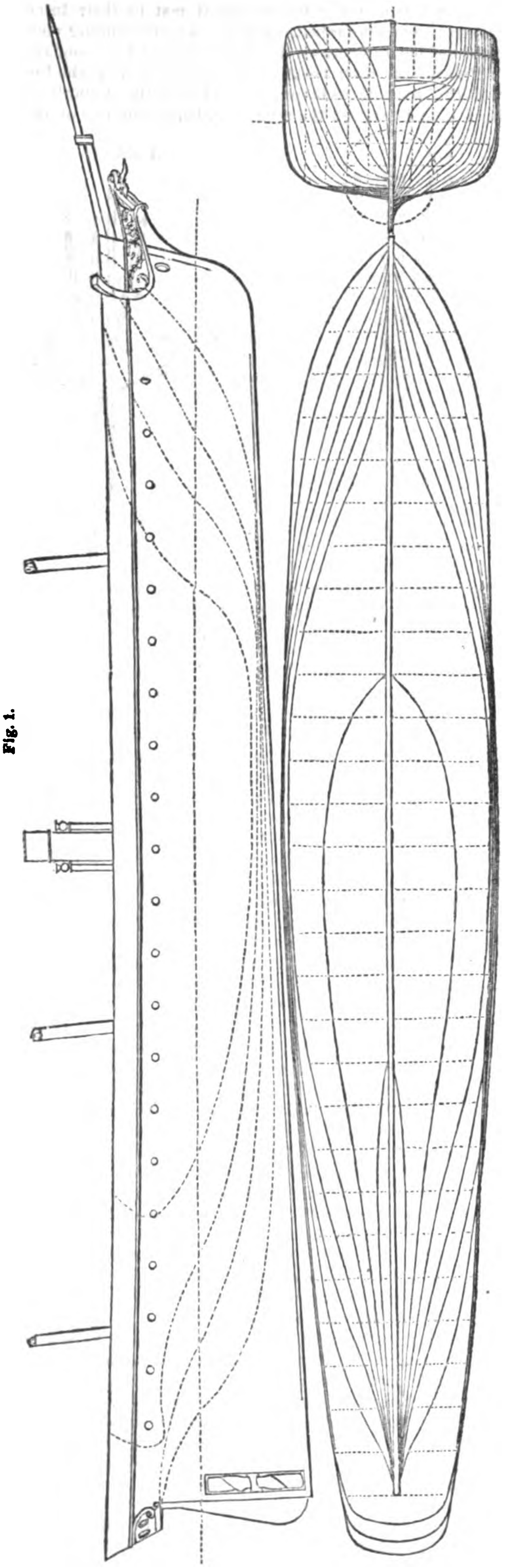


Fig. 3.

Fig. 2.

Fig. 1.

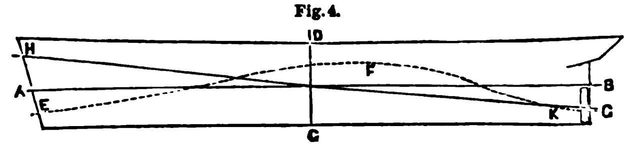
however, has yet to be combined sailing qualities and sea-worthiness, which will all be found in the form delineated in the annexed engravings. Fig. 1 is the sheer draught; fig. 2, a plan on keel; and fig. 3, an end view, half-bow, half-stern.

The keel of this vessel has a considerable dead-rise (the inclination of which can be altered according to circumstances), giving a great draught of water aft, and little at the bow. The bottom, near the bow, is flat, or nearly so, and from that place the bilges run parallel with the water-level, and not with the keel, as is usual, giving a certain twist to the bottom, gaining gradually more inclination towards the after part of the vessel, until it falls in a perpendicular at the stern. This dead-rise of the keel is given for three purposes—to allow of the application of a large screw of a coarse pitch, to prevent the vessel from pitching too hard in a heavy sea, and to obtain speed.

The water-line is drawn in the plan with slightly bolder lines. It has a sharp entrance, and a very easy run; every following line downwards is sharper aft than the preceding one, to such an extent that the water runs with the least possible impediment towards the stern, a portion of which is entirely out of the action of the backwater, and therefore making no vacuum itself to the vessel, which is undoubtedly a gain of power.

As a sailing vessel it can hardly be better, as those qualities which have crowned the yacht *America* with success, fall naturally to this form, proving it to go easily through the water. Let us suppose fig. 4

Fig. 4.

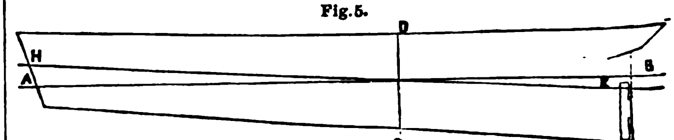


to be a screw steamer of the ordinary form, where the draught of water is the same fore and aft; A, B, being the water-line, and C, D, that part of the section where the centre of gravity lies. If such a vessel is on the top of the wave, and the main support falling behind the centre of gravity, as shown by the dotted line, E, F, G, the fore part of the vessel being less supported than the back part, the vessel pitches down, and remains, head downwards, until another wave approaches and swells up on the bow, perhaps to twice the draught of the vessel, to raise it again. Hence there are instances when the bow is deeply immersed, whilst the stern with the screw comes partly out of the water, as represented by the line, H, K.

At the moment a vessel pitches, its progress is checked to some extent, and the screw being at the same time insufficiently immersed, partially loses its action against the water, so that the next moment it has to give a fresh start to the vessel, whence arises the labour experienced by a screw steamer in a heavy sea. This is an ancient tale, but I am obliged to cite it by way of showing more clearly the difference between the old and the new plan.

I will suppose fig. 5 to represent a steamer of the proposed new form,

Fig. 5.



A, B, being the water-line, and C, D, that part of the section where the centre of gravity is. The bow of this vessel drawing but little water, and being very light, is lifted rapidly at the approach of the next wave, which also swelling up to double the original draught of the bow, or a little more, as indicated by the line, H, K, is yet far from reaching the deck-line, and the centre of gravity being further aft, the difference will be yet smaller at the stern than the bow; hence the screw will be more regularly immersed, with an action more uniform and effectual. I am perfectly well aware that waves are not very regular, and that ships get into all sorts of strange positions; but this has nothing to do with the difference between the two systems which I have attempted to explain.

I need say nothing as to the pecuniary advantages of great speed—every one is fully aware of it; but there is another point which is not much thought of. A clever captain, who is acquainted with the winds and storms, and their courses at sea, will generally be able, with a very fast steamer, to avoid a storm, at least to some extent; and if he catches an edge of it, with a steamer like the one here described, which pitches so little, he will be able to steam on at full speed, and, consequently,

his trips will be performed with greater regularity than with a slow steamer, for the latter will be nearly always overtaken by a storm, when its speed must be slackened.

Another advantage of this new form of vessel is, that she may be launched with her engines on board, because the ways will have about the same inclination as the keel, and therefore the vessel will retain the same inclination as it enters the water, and be well supported at all times during launching.

E. A. Bourry.

New York.

MECHANIC'S LIBRARY.

Assayer's Guide, fcap. 8vo, 4s. 6d., cloth. O. M. Lieber.
Chemistry, Outlines of, 18mo, 10d. Griffiths.
Churches in Kent and Sussex, Notes on, 8vo, 18s., cloth. Hussey.
Eccentric Turning, Concise Treatise on, small 4to, 21s., cloth.
Geology, Outlines of, 18mo, 10d. Zornlin.
Great Exhibition Building, 4to, 31s. 6d. Downes & Cowper.
Great Exhibition Reviewed, post 8vo, 14s., cloth. Dr. Lardner.
Humboldt's Personal Narrative, vol. 2, Bohn's Scientific Library, 5s.
Industry, Curiosities of, 8vo, 5s., cloth. G. Todd.
Literary and Philosophical Subjects, Papers on, 7s. 6d. Macdougall.
Locomotive Engineers, Hand-Book for, post 8vo, 8s. 6d. S. Norris.
Plane and Spherical Trigonometry, 8th edition, 7s. 6d., cloth. Snowball.
Practical Geometry, Elements of, 12mo, 1s. 6d., cloth.
Practical Model Calculator, 8vo, 14s., cloth. O. Byrne.
Science, Appendix to Guide to, 2d edition, 18mo, 1s., cloth. Dr. Brewer.
Science, Dictionary of, 2d edition, with Supplement, £3. Brande.
Shipmaster's Assistant, new edition, 8vo, 28s., cloth. Steel.
Turning, Hand-Book of, new edition, 12mo, 7s. 6d., cloth.

RECENT PATENTS.

MANUFACTURE OF PLAIN AND FIGURED FABRICS.

F. W. Norton, *Paisley.—Enrolled June* 16, 1852.

Mr. Norton's important invention relates to the manufacture of such fabrics as are technically termed "furnitures," or furniture drapery, such as table-covers, curtains, tapestries, carpets, and trimmings. The fabric is peculiarly novel, yet it is capable of being worked in the ordinary loom, with the modification of attaching a species of "cross heddle" to work in conjunction with the ordinary harness or heddle mounting. This cross heddle is arranged to work through the ordinary pair of main vertical heddles, and it has a central ring or loop formed in it, through which loop is passed the plain or printed pattern yarn thread intended to form the surface of the fabric. The warp threads pass from the ordinary yarn beam through the reed in the usual manner. But, in addition to this yarn beam, the loom is provided with a secondary beam or roller, carrying upon it a line of foundation threads of any suitable material, and of a fineness proportioned to the effect intended. In some cases, a cheap and coarse material will answer for this foundation warp. The threads of this secondary warp are passed along, just beneath the line of the surface warp threads, a thread of each warp being passed together through each dent of the reed; so that, when woven, the secondary warp threads serve as a base or foundation to carry the surface warp threads.

During the weaving action, the heddles are actuated in such manner that, whilst one vertical heddle descends, as in the ordinary arrangement, to produce the shed, it draws down the cross heddle, and with it the line of pattern or surface warp threads, in such way that each loop or ring of this cross heddle is brought down beneath the level of its corresponding foundation warp thread, and, in this instance, on the left side of the latter. Whilst the harness or heddles remain in this position, a shot of weft is passed across the piece—the weft thread from the shuttle being conveyed along over the top of the warp threads, and beneath the foundation threads, so that the weft so passed binds or holds down an angular loop or bend of the warp thread to the left side of each foundation thread. Then, in the course of weaving, the heddles are reversed for the next shed; and the reverse vertical heddle, or the one which remained elevated during the last movement, now descends, and a similar action occurs on the opposite or right side of each of the foundation warp threads; that is, each cross heddle-ring draws its warp thread across its corresponding foundation in the opposite direction, or to the right—the warp thread being passed down beneath the foundation thread as before,—and the next weft shot then secures this reverse set of angular loops, and holds in each case a portion of the surface warp across or over the surface of the corresponding foundation thread. In this way the weft shots secure the warp in a species of zig-zag over the foundation thread, without the actual formation of any loop. Then, as the reed beats up the weft threads in the sheds, it also presses up at the same time the zig-zag threads of the surface warp close together, so as to bring each bend or angle of the warp threads to a right angle, or nearly so, with the line of foundation threads.

Fig. 1 is a diagram of the heddles as at rest in their intermediate position, when no shed is formed. Fig. 2 is a corresponding view, showing the cross heddle-rings drawn to the left side of the foundation warp threads. The surface warp beam for the pattern is at A, the line, B, being that of the warp threads passing individually through the cross heddle-rings, C, and through the reed, D, E, being the line of the woven

Fig. 1.

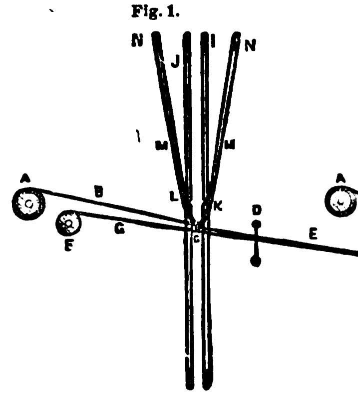
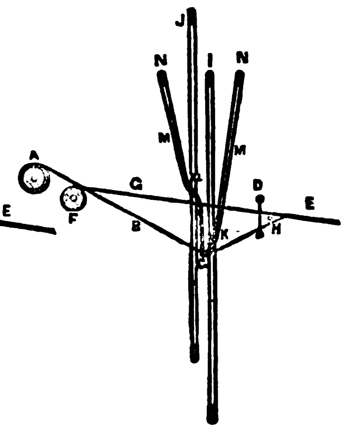
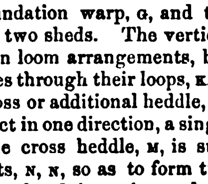


Fig. 2.



fabric. The foundation warp beam, F, is so placed that its line of threads, G, shall pass just beneath the line of the pattern warp. These threads do not pass through the heddle loops, but proceed direct to the reed, each dent of which has a thread from both warps passed through it. The fabric, then, is simply composed of three several sets of materials or threads—the pattern warp, B, the foundation warp, G, and the cross-binding weft, H, as passing through the two sheds. The vertical heddles, I, J, are fitted up just as in the common loom arrangements, but no portion of the materials for the threads passes through their loops, K, L, these loops being merely used to actuate the cross or additional heddle, M; and the vertical heddles being only required to act in one direction, a single knot or stop only is necessary in each. The cross heddle, M, is suspended by each extremity from the fixed points, N, N, so as to form two pendant sides, terminating at the bottom loop or bend in a ring or loop, C. Each side of the cross heddle is passed through the loop, or beneath the knot of its corresponding vertical heddle, I, J, the ring, C, being freely suspended between the two heddles. Fig. 1 represents the arrangement of the harness in its inert state, the line of pattern warp threads being above the foundation warp, so that no shed is formed to either side. In fig. 2, the heddle, I, has descended so as to carry the line of cross heddles, with their rings, C, to the left side, or behind their respective foundation warp threads, G. This movement correspondingly sinks the pattern warp threads, B, bringing them out of the straight line into an angle beneath the level of the foundation warp line, G, which constantly retains the same level. This forms the shed, and the succeeding throw of the shuttle then carries a weft thread, H, over the depressed line of pattern warp threads, and beneath the foundation warp. In the reverse action of the heddles, the elevation of the heddle, I, slackens the cross heddle on that side, and the depression of the heddle, J, draws the pattern warp over the surface of the foundation, by pulling down its side of the cross heddles, and bringing their rings, C, to the right side, or in front of their corresponding foundation threads. This forms the reverse shed, and a bend of the pattern warp having been held down, by the last weft shot on the left side of the foundation, the succeeding shot for this reverse shed being similarly passed between the pattern and foundation warps, now holds down a corresponding bend on the right side of the threads of the latter, the portion of the pattern warp between these two bends being thus laid over, and covering the foundation warp at that part. The diagram, fig. 3, is a plan of a portion of the fabric so woven—showing one or two of the pattern or surface warp threads, as they would appear before being beaten up by the reed—in a series of zig-zags, the portion, O, being the finished fabric, where the zig-zags are beaten up individually into a

Fig. 3.



series of crossings over the foundation threads, at right angles, or nearly so, thereto.

The same arrangement is also applicable for passing each surface warp thread over two or more foundation threads, or over alternate and irregular numbers of the latter threads; and the surface warp threads may likewise be caused to intersect each other, whilst passing right and left, as described, producing another variety of fabric. The patentee's object, in all his modifications, is the formation of a fabric with a full or solid corded surface, by crossing the surface warp back and forward over its foundation, so as to take up the length of the warp thread without the formation of any loop. The result of this is a full even fabric, consisting of a series of cords covered with the crossed warp threads, and held together transversely by the crossing of the weft shots.

This system of weaving obviously affords great assistance in weaving printed or dyed warps; for the crossing of the figured warp, printed with an elongated pattern in the usual way, takes up the threads in a very simple and inexpensive manner, whilst the surface being formed entirely by the warp, without any interference from the other threads, the pattern has a much fuller and better effect. The fabric is also cheap, for the expensive surface or pattern warp threads are only *veneered*, as it were, over a foundation of coarser material.

PRINTING SURFACES.

JOHN CUMMING, *Paisley.—Enrolled June* 15, 1852.

This is a practical application, by a practical designer of ornamentation for printed fabrics, of the electrotypic system of producing figured surfaces for the calico and silk printer. According to one modification of his routine of processes, Mr. Cumming proceeds by taking a thin smooth copper plate, silverized on one surface, and on this silvery surface he deposits a thin layer of copper, by immersion in a solution of sulphate of copper, under the ordinary well-known electro-deposit process. When a thin layer of copper has been obtained in this manner, the plate is removed from the copper solution, and a sheet of fine silver wire-gauze is laid upon the newly-deposited copper layer. In this state the whole is again subjected to the electro-deposit process, and a second, but very slight, deposit of copper is made on the back or surface of the wire-gauze. This latter deposit is continued until the penetration of the deposited metal between the meshes of the gauze, shall connect the latter firmly to the copper layer beneath it. When this is done, the first copper layer is detached by heat in the usual manner, as practised by electrotypists; the plate so detached having a smooth copper surface on one side, and an adhering sheet of wire-gauze on the other. The intended pattern is now drawn or formed on the smooth face of this plate, in or by a suitable varnish. This varnish must be a non-conductor of electricity, and may be composed of mastic, shell-lac, or other similar substance. When the figure is so drawn or produced, the prepared plate is immersed in a vessel containing a solution of a metallic salt, and is then put in communication with the negative pole of a galvanic or voltaic battery. This treatment has the effect of reducing or eating away all those parts of the plate which are uncovered by the varnish or protecting coating, and the figure, formed by which coating, is therefore left in relief, and projecting from the surface of the wire-gauze.

By another mode, Mr. Cumming proceeds with a plate having its pattern drawn on it as already described, immersing it in a nitric acid solution, the reverse side of the plate and the wire-gauze being covered with a varnish. In this way the pattern side of the plate is acted on by the acid, leaving the relief figure above the wire-gauze. The varnish is then washed off, and the relief figures are heightened by a very curious and ingenious process. The figured surface is laid downwards, upon a layer of some soft non-conducting material, as strong boiled oil or mastic in a thickened state, and pressure is applied to the back of the plate to cause the soft material, on which the gauze surface rests, to percolate through the meshes of the latter, filling up all the spaces behind it, as left between the lines of the relief figure, leaving the figured surface clear. The plate so treated is then removed and immersed in a solution of sulphate of copper, and is connected to the positive pole of the battery. The deposit of copper is then carried on upon the figured surfaces, until the required additional relief is obtained; or, if a great projection is necessary, the process of filling up with the non-conducting matter is alternated with the electro-deposition, until the pattern lines are in sufficient relief. A metallic back is then formed over the entire surface, by heating it with plumbago, and then depositing copper over it. The operation is completed by separating the wire-gauze having the front skeleton of the device on it, by heat, in the usual manner, and the skeleton so obtained then answers for the production of future copies of the figure, whilst the lines deposited on the plate are left in a complete state, ready for attachment to the printing apparatus.

But probably the most practically valuable of all the patentee's processes—as well as the simplest—is one in which he takes a silverized plate, and coats it with a partially-conducting ground, composed of white lead and tallow, wax and turpentine. This forms an etching ground, and is laid on in a melted state, so that the white lead may fall down to the metallic surface. When hardened and made level, the pattern is traced out upon it, and the artist then etches down through both the external greasy coating and the layer of lead, with an etching point, which is passed clear down to the metal surface, so as to lay bare the plate along all the pattern lines; or, instead of drawing the figure on the ground, or transferring it from paper, it may be traced out by the pentagraph on any scale required, from an original drawing—or the pentagraph may carry an etching needle to cut out the lines at once. If higher relief than that afforded by this ground, as etched, is required, the coating may be thickened by pouring tallow on the blank surfaces. The plate is then submitted to the electro-deposit process, so as to fill up all the etched lines with copper; and here the elegant idea of the employment of white lead in the ground comes into play, for its presence will cause the due conduction of the electrical action to those parts of the lines where the coating may not have been fully removed by the etcher.

The electro-deposition is continued until the pattern lines are filled up, when the entire surface is brushed over with plumbago, and a solid metal back is then deposited over it. The plate is completed by separating the figured surface from its silverized matrix, when the plate may be mounted to print from.

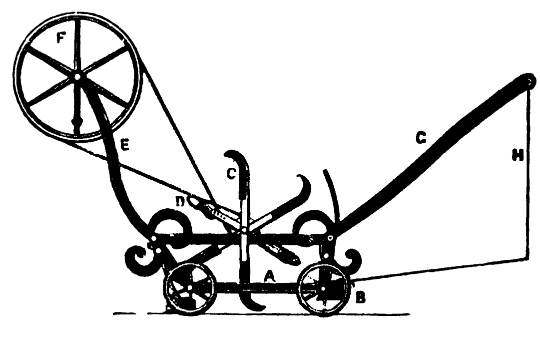
The patentee describes one or two other modifications of his plans—such as the formation of *intaglio* printing surfaces, with the aid of iron in combination with copper; the case-hardening of electro-deposited iron surfaces, to enable them to produce fac-similes by pressure, as in "milling;" and the formation of separate plates for varieties of colours in one pattern. The processes are in active operation at the works of Messrs. Whitehill & Co., at Paisley, where we have seen some very beautiful designs worked out with remarkable speed and accuracy, the etching out of the ground being so simple and easy as to be performed by mere children. The economy of the process is undoubted.

REGISTERED DESIGNS.

BOX-EDGING CUTTER.

Registered for MESSRS. P. LAWSON & SONS, *Seedsmen, Edinburgh.*

This little apparatus has been devised for saving time and labour in cutting the fringes of boxtree, which form such neat and effective edgings for garden plots, as well as for doing the work with an amount of accuracy which is totally unapproachable under the ordinary manual system of cutting.



It consists of a light rectangular metal frame, A, carried on four running wheels, B, and having on its upper edges a couple of bearings for the horizontal shaft of a set of six revolving cutters, C, D. Four of these cutters, C, are formed somewhat like common reaping-hooks, being forged on the ends of a set of arms, for cutting the sides of the box, so arranged upon the shaft, in reference to the two remaining arms, D, that the whole are at equal distances asunder in the line of revolution. The latter cutters, D, are adjustable upon the two ends of a double arm; they are peculiarly curved laterally, and are intended for cutting the top of the edging. The whole series is held on the shaft by end screws and intermediate washers, so that, whilst the adjustment of the washers admits of the regulation of the cutters, C, as to the width of edging, the

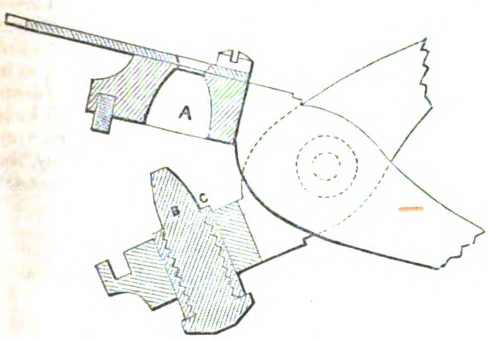
other two are variable as to height, by the screws in the arms. Thus, by adjusting the distance between the two sets of side-cutters, C, the width of the edging is at once determined; whilst any contour may be given to the top by a suitable curvature of the cutters, D. At one end of the frame, two projecting standards, E, are fixed, for the purpose of carrying the shaft for a band or cord-pulley, F, an endless cord from which passes to a smaller pulley, fast on one end of the cutter-shaft. The other end of the frame has also a pair of standards, G, with a pair of side-handles, for assisting in traversing the apparatus, and also to carry a light vertical rod, H, to the bottom of which a string is fastened by one end, the other being passed backwards to the framing, to give a centre guiding line for the operator.

In using the machine, it is set over the edging to be cut, two of the wheels, B, running along each side; and the operator then pushes it forward by a handle at the top of the standards, E, whilst he turns the pulley, F, by a winch fastened upon it, the dragging of the machine being aided, when necessary, by a man at the front end. As the cutters are driven at a very rapid rate, a very clean and accurate cut is given, and the extent of work performed, stands in very favourable contrast with that obtainable from manual labour only.

MOULD FOR HOLLOW PROJECTILES.

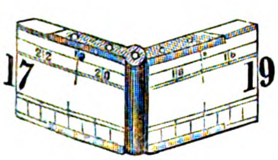
Registered for MR. J. B. PALMER, *Holyhead Road, Wednesbury.*

The "Minié" ball has become a fruitful source of invention. Mr. Palmer's contribution to its many modifications and varieties of apparatus, provides very ingeniously for casting different weights and sizes of bullets, and different depths of hollow in one mould. Our figure is a plan of the open mould, with the jaws in longitudinal section. The concave acorn-shaped recess, A, in the upper jaw, forms the external contour of the ball, the internal hollow of which is produced by the entry therein of the projecting core, B, screwed through a collar, C, in the lower jaw. This collar is cylindrical, and is set loosely in an eye bored out of the jaw, and capable of a fixed adjustment at any required point, by a side set-screw set in the jaw, and pressing on the collar. The latter is just large enough to enter the mouth of the recess, A, so that, by adjusting it with more or less projection through the jaw, and screwing back or forward the screwed core, B, by means of its head on the other side, the length and amount of hollow of the ball may be set to the greatest nicety.



RULE JOINT.

Registered for MESSRS. QUINTON & Co., *Icknield Street, West, Birmingham.*



The simple modification involved in Messrs. Quinton's rule joint is pretty clear from the annexed figure. Instead of the edge joint usually employed, a joint on the flat is made by the external edge-pieces, somewhat like the hinge of a house-door, insuring great strength with simplicity of construction.

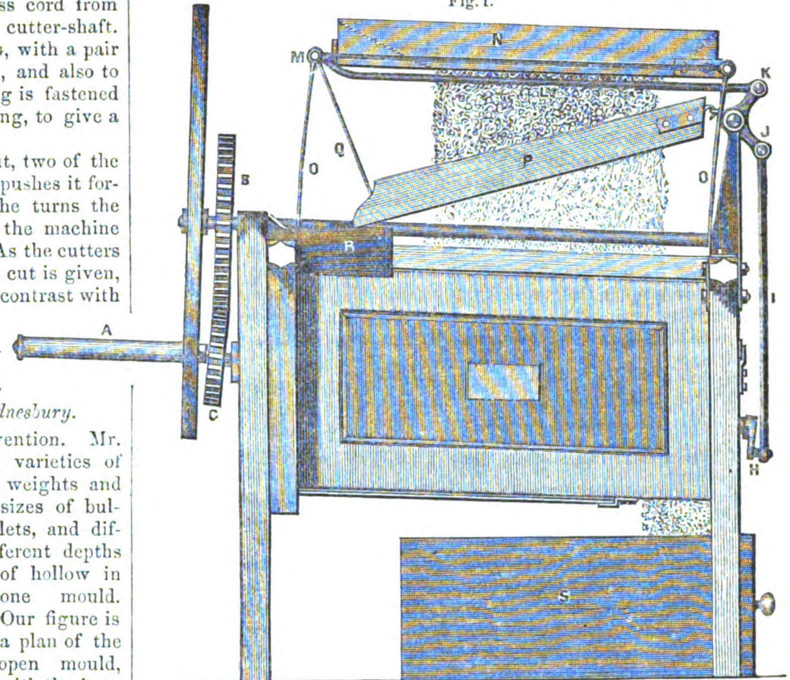
CURRANT-DRESSING MACHINE.

Registered for MR. MILES BUCK, *Skeyton, Norfolk.*

This is a modified adaptation of the general arrangements of the ordinary flour-dressing machine, for disintegrating, cleansing, and separating the stones, dust, and other foreign and unpleasant matter from currants, as they are delivered to the merchant from the currant-growing districts of Zante and Smyrna.

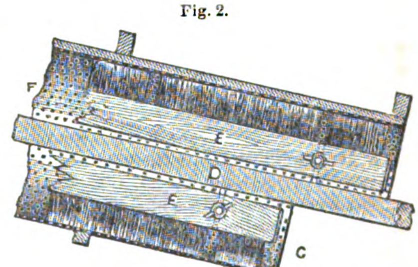
Fig. 1 of our engravings is a complete external side elevation of the machine, and fig. 2 is a longitudinal section of one end of the dressing cylinder and brushes detached. The machine is actuated by the winch, A, fast in the side of a large fly-wheel on the end of a long shaft passing

Fig. 1.



directly across the machine, and having keyed upon it a spur-wheel, B. This wheel gears with a second and smaller wheel, C, fast on the projecting end of the long square shaft, D. This shaft carries two long brushes, E, the stocks or holders of which are adjustable by means of set screws or pins projecting from the shaft, so that they may be adjusted at any time to fit the ends of the bristles up against the interior of the dressing cylinder, F, or removed for repair. The upper inclined end of the dressing cylinder receives the uncleansed currants, and about $\frac{1}{2}$ the length of the brushes towards this end is therefore made of a stouter material, such as whalebone, piassava, or foreign grass. The remaining portions of the brushes are common bristles, the cleansed currants being discharged by them at G. On the opposite end of the shaft, D, is a short crank, H, from which a connecting-rod, I, passes upwards to an arm, J, of a bell-crank at the top of the framing. The other arm, K, of this bell-crank is jointed to one end of a horizontal rod, L, which extends to the front of the machine, and is hooked at M to a cross rod of a rectangular frame passing all round the tray, N. The latter is supported at each end on the tops of two blade springs, O, so that the revolution of the crank, H, gives a quick vibratory springy motion to the tray, which rests entirely on the springs. The raw currants are placed in this tray, which has a bottom perforated with holes about $\frac{3}{4}$ inch in diameter, and, in passing through, they become disintegrated so as to loosen the dirt. The whole mass then falls through upon the perforated tray, P, which is hooked at its highest end to one of the springs, O, whilst the other or lower end is suspended by the rod, Q, from the tray above. The lower tray thus receives a vibratory motion also, and, having holes of about $\frac{1}{8}$ inch in its bottom, the dirt falls through, whilst the partially cleansed currants are discharged from the lower inclined end into the receiver, R. This delivers the currants into the elevated end of the dressing cylinder, the action of which we have already described. The cleansed currants

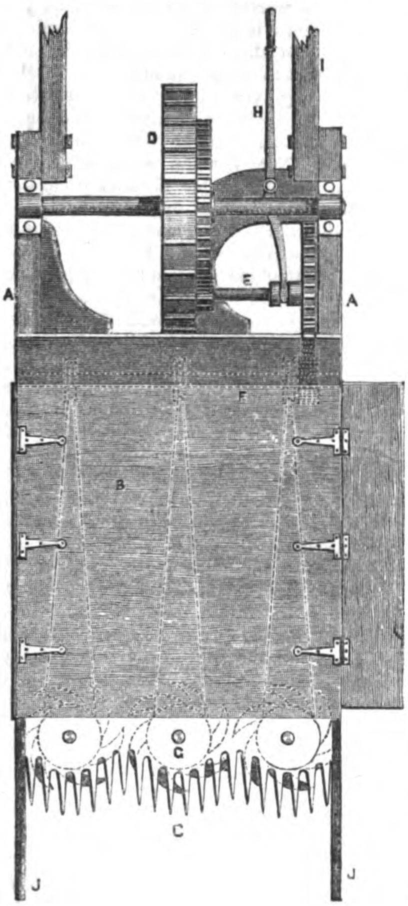
Fig. 2.



are finally delivered into the bottom box, s, whilst the dirt is brushed through the cylinder. The old machines hitherto used cleanse no more than about 1 cwt. per day, whilst this machine is capable of getting through 2 cwt. in an hour.

REAPING MACHINE.

Registered for MR. F. MASON, *Ipswich.*

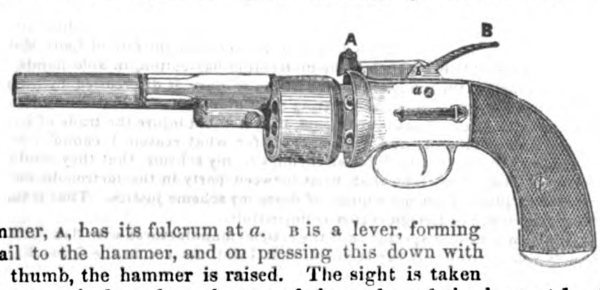


This machine differs essentially from its celebrated American contemporary, in having rotatory cutters. Our figure represents it in plan, as it would appear when the spectator is standing at the cutting end of the machine. The frame, A, to which the shafts for drawing the machine are attached, carries a floor, or platform, B, with hinged flaps at the sides, and carrying on its front edge a series of combs, or teeth, C. The opposite end of the frame carries bearings for a cross shaft, at the centre of which is a travelling wheel, D, having attached to it a spur wheel for actuating the pinion, E. The shaft of the latter carries a second wheel, in gear with a second pinion on the shaft, F, beneath the floor. The latter shaft has upon it three pulleys, communicating motion by means of endless chains, or bands, to the three horizontal pulleys fast on the shafts of the horizontal rotatory cutters, G. The cutters are capable of being engaged or disengaged at pleasure by the lever, H, and sliding clutch. The shafts, or guiding handles, by which the machine is directed, are broken away at I, the machine being traversed by the drag links, J. Those who have seen any of the existing reaping machines, will easily comprehend the essential features of Mr. Mason's invention.

REVOLVER WITH LEVER COCK.

Registered for MR. T. K. BAKER, *Gunmaker, Fleet Street, London.*

The object of the peculiarities of this pistol is, to enable the user to perform the cocking, revolving, and discharging with one hand. The



hammer, A, has its fulcrum at *a*. B is a lever, forming a tail to the hammer, and on pressing this down with the thumb, the hammer is raised. The sight is taken over a notch, formed on the top of the surface of the lever at *b*. By this arrangement, the pistol possesses a very great advantage over ordinary arms of this class, where it is necessary either to shift the hand to draw up the hammer, or drag at the trigger to force up the cock, so as to cause an uncertain aim.

GAS COOKING STOVE.

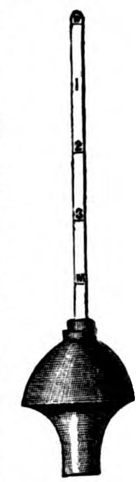
Registered for MR. G. BOWER, *St. Neot's, Huntingdonshire.*

An extremely careful copy of Mr. Graham's gas-stove. Our readers will form a very clear idea of Mr. Bower's invention, by turning to page 280 of our third volume, where Mr. Graham's arrangement is fully illustrated and described; and we are, therefore, relieved from the task of further description.

MILK TESTER.

Registered for MR. GEORGE, *Adelphi Arcade, Strand.*

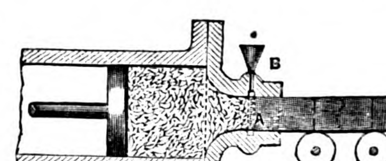
The extent to which the adulteration of milk is carried is so notorious, that any means of detecting it must be at least matter of interest, and worthy of trial. Our engraving is a half-size representation of a unique and simple little instrument, invented for this purpose by Mr. George. It is constructed on the principle of the hydrometer, depending for its action on the fact of the different specific gravities of milk and water. It consists of a float, with a rod attached to its top, on which are several divisions, the top one being marked W (water), the bottom one M (milk), and the intermediate ones, 1, 2, 3, or according as the scale may be divided. The instrument, before being used, requires setting, which is accomplished by floating it in water, care being taken that it becomes quite wet, and that no air bubbles remain attached to it. It is then weighted by dropping little rings on the rod till the water level coincides with the division on the scale marked W; if this cannot be done exactly, an allowance must be made for the difference. If, when the tester is immersed in milk, the division marked M is at the surface, then the milk is unadulterated with water; when it stands at division 3, there are three parts milk to one water; when at 2, it is "half-and-half;" and when at 1, it is only one part milk to three water. If it stands at any part between the divisions, of course the corresponding proportion is indicated—as, for example, $1\frac{1}{2}$ milk to $2\frac{1}{2}$ water.



BRICK DIE.

Registered for MESSRS. FOWLER & FRY, *Temple Gate, Bristol.*

The object of this modification of, or rather addition to, the common moulding die, is the prevention of the injurious friction of the clay surface against the interior of the die, as it exudes from the clay receiver to the carrying table. In the manufacture of solid bricks, this friction has always been a very serious difficulty, for the rubbing of the external faces of the moulding clay upon the metal, tends to hold back a film of the clay externally, whilst the central body portion holds on its way. This leads to the disintegration of the finished brick surfaces, causing the roughness and distortion, of which the builder justly complains. Our figure illustrates Messrs. Fowler and Fry's simple plan of getting over this evil. It is a longitudinal section of part of the clay cylinder, with its forcing piston, die, water funnel, and lubricating channel, and the carrying table. The neck of the die has an annular channel, A, turned out in it, and a small hole is bored through to the upper side to communicate with the funnel, B, containing a supply of water. In this way the clay is surrounded by a fluid ring, which moistens the clay surface, and allows the brick to emerge smoothly.



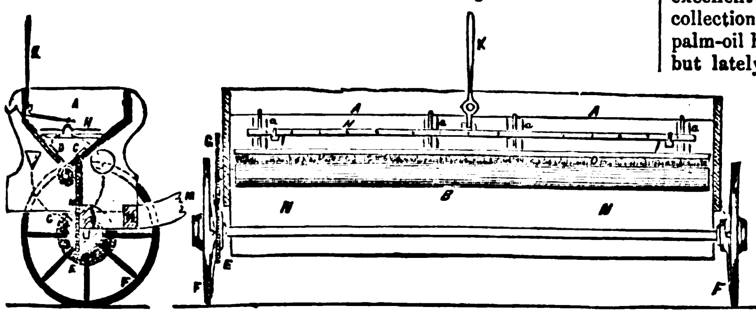
MANURE DISTRIBUTOR.

Registered for MR. EDMUND FOGDEN, *East Dean, Chichester.*

Fig. 1 is a longitudinal sectional elevation, and fig. 2 a cross section of this machine. A A is a long box, or hopper, into which the manure in a powdered state is put; B is a fluted roller, which occupies a position

parallel to a long slot in the bottom of the box; C and D are two brushes, the bristles of which press against the roller, B. The front brush, C, is fixed to the side of the hopper; the other, D, is capable of being slid further up from, or closer down upon the roller, by screws, *a a a*, according to the quantity of manure which it may be thought fit to allow to

Fig. 2. Fig. 1.



escape; E is a spur, which is fixed to the nave of one of the bearing-wheels, F F, and which gears into a wheel, G, affixed to the end of the roller, B; motion is thus communicated from the bearing-wheels to the roller, to cause the dispersion of the manure. H is a bar, which runs along the centre of the hopper, A, in which it is supported by cross bars, I; this bar is furnished with a set of projecting arms, and is acted upon by a lever, K, so that the attendant may, by moving the lever, prevent the manure from getting clogged or arched in the hopper. The shafts are attached to the machine at M. N is a guard-board, to prevent the wind from scattering the manure.

The simplicity, cheapness, and effective distributing powers of this machine, have already caused its extensive introduction in various parts of England.

REVIEWS OF NEW BOOKS.

ON THE VEGETABLE SUBSTANCES USED IN THE ARTS AND MANUFACTURES IN RELATION TO COMMERCE GENERALLY. By Professor Edward Solly, F.R.S. Bogue, London. 1852.

As knowledge of natural substances increases, the arts and manufactures of a country become more extended. The wealth which nature gives, stimulates them to grasp at more. What is now a luxury, in a few months becomes a convenience, and, in a further short time, a necessary of life. The curiosity which first led to the introduction of a natural substance into art or manufacture, little thought that it was originating a department of human action which was destined to employ the millions of the earth, by sea and by land, in a mutual play of giving and taking. And yet what is commerce more than this? or can art or manufacture find a different parentage? As the arts and manufactures increase by the discovery of new natural products, or the invention of new methods of treating them, and the necessity or expediency of dividing labour, what is called "raw produce" increases in a like ratio. It will be seen at once, therefore, of what wide significance is the subject of the present discourse. On this point, Mr. Solly must speak for himself:—

"In using the term 'raw produce,' it must be borne in mind that it is not to be confined to those substances which, in their crude and natural condition, form articles of commerce; but rather to those vegetable materials, whether crude or partly manufactured, which constitute the basis of the arts and manufactures—the crude matter on which the manufacturer exerts his skill, and which it is the especial object of his art to render fit for some new and useful purpose. It is in the state in which he obtains it; and it is, therefore, truly speaking, the raw material of his art, although, at the same time, it may really have undergone a long series of preliminary processes and operations."

Correctly to describe the kinds of raw produce which would thus come under the head of vegetable substances, might fill volumes. The author limits himself to some few of the more important. In this way he has a running commentary upon gums and resins, caoutchouc, gutta percha, oils, dyes, cotton-flax, other fibres, and timber. In the course of this he mentions many interesting facts. We shall not follow him in his order, but mention them as they recur to us.

The important manufacture of starch has undergone, it is well known, many changes for the better during the last few years; and starch itself has become so useful, that, from only recently having made it out of wheat and similar grains by fermentation, chemical science has been applied, and it is now obtained from a multitude of sources. Sago, after merely washing and bleaching, yields very nearly cent. per cent. of starch. It has been found, also, that certain excellent resins but lately have been in use. The fine red resin of the Xanthorrhœa of New South Wales, the beautiful Cowrie resin of New Zealand, and the fine hard resins from Courg, were but recently merely exposed as curious objects in our museums. Shell-lac, from Singapore (a new locality), of very excellent quality, became generally known through the East Indian collection in the Great Exhibition. The introduction of cocoa-nut and palm-oil has given rise to a commerce in various other vegetable oils, but lately entirely unknown, and well worthy attention—such as the vegetable tallow of the vateria indica, the fat of the various cassias, the oil of the carapa, the oils of the garcinia, and of the vernonia, and the vegetable tallows of China and the Archipelago islands. Among dyes, many colouring matters are brought into good use, and point to a multitude of others: thus, munjeet, chayroot, the black indigo of the Shan country, and the black dye of New Zealand, are now rapidly getting into estimation. A remarkable instance occurs of the benefit of science on the subject of dyes. "It was observed," we are told, "that some of the madder grown near Avignon, was inferior in the richness and brilliancy of its colour to that produced in other districts; and the proprietors being anxious to discover the cause, were led to institute a chemical examination of the soil of their own land, in comparison with that of some of the best madder farms. The result showed that their soil was deficient in lime, whilst all the others contained it. They were therefore induced to give their land a good dressing of lime, and the result fully justified them, for the next year their crop of madder was inferior to none." Mr. Solly refers to the introduction, through the medium of the Society of Arts, of the now necessary article gutta percha, and reminds us of the council having encouraged the importation, by awarding their large gold medal to Dr. Montgomerie, for drawing attention to its remarkable and valuable properties. The Great Exhibition introduced to notice another valuable product of this description, namely, the cattimundoo from Vezianagram, and which is likely to become a valuable import. The useful qualities of China grass, and some few other vegetable fibres, are beginning to be estimated; but most of them, however, are likely still to retain their character as curiosities only. With the former may be mentioned the jetee, or bowstring hemp of Rajmehal, the fibre of the *calotropis*, or *asclepias tenacissima*, and the fibres of the *sanseveria* and *hibiscus*. But of all vegetable substances, cotton stands, of course, pre-eminent as an article of commerce. We now import the extraordinary quantity of about 80,000,000 lbs. per year—the value of which, when manufactured, can hardly be less than £30,000,000 sterling. Of this large quantity, 84 per cent. comes from North America, 10 per cent. from the East Indies, nearly 4 per cent. from Brazil, and rather more than 2 per cent. from the Mediterranean. That at present imported from the British colonies does not quite amount to one million pounds per annum. It is, however, rapidly increasing, and, as regards quality, is highly deserving of praise. "The cotton of British Guiana is excellent." The North American cotton generally reaches Europe in the best possible condition for the subsequent operations of the manufacturer. The flax-cotton, to which some recent patents have excited attention, is, it seems, not so new a manufacture as is generally supposed. We transfer to our pages an interesting anecdote which the author gives relating to this singular substance:—

"In the case of flax-cotton, we have recently been strongly impressed with the great importance of a discovery, by means of which the fibre of flax can be converted into a sort of cotton, capable of being carded like ordinary cotton, possessing the advantage, that it may be employed with wool or cotton in the manufacture of mixed fabrics, and having an increased affinity for colouring matters. Now, nearly all this was done about eighty years ago by Lady Moira, and is published in the first volume of the Society's Transactions. She states that tow and refuse flax of all sorts, boiled with an alkaline solution, and afterwards scoured, is converted into a sort of cotton, which she believes takes the dye better than flax. The result of this process is, that 'the fibres separate from one another,' after which it may be carded like cotton. It is highly interesting to observe the fate of Lady Moira's scheme: she says—'It is plain that the material of flax-cotton, in able hands, will bear manufacturing, though it is my ill fortune to have it discredited by the artisans who work for me . . . . . and getting spun an ounce of this cotton in Dublin I found impracticable. The absurd alarm, that it might injure the trade of foreign cotton, had gained ground; and the spinners—for what reason, I cannot comprehend—declared themselves such bitter enemies to my scheme, that they would not spin for me. Such is my fate, that, what between party in the metropolis and indolence in this place, I am not capable of doing my scheme justice. That it should ever injure the trade of foreign cotton is impossible.'

"Lady Moira sent over specimens of the articles manufactured with flax-cotton to the Society; and I will only say of them, that I did not see in the Great Exhibition any better samples of flax-cotton than those prepared more than seventy years ago. I will also quote to you a brief statement by Mr. Bailey of Manchester, contained in a letter to the Society, dated 1775:—'Some of the most ingenious manufacturers in and about Manchester are most extremely pleased with this new staple,

and think, if properly attended to, Lady Moira's invention may prove a fruitful source of wealth.'"

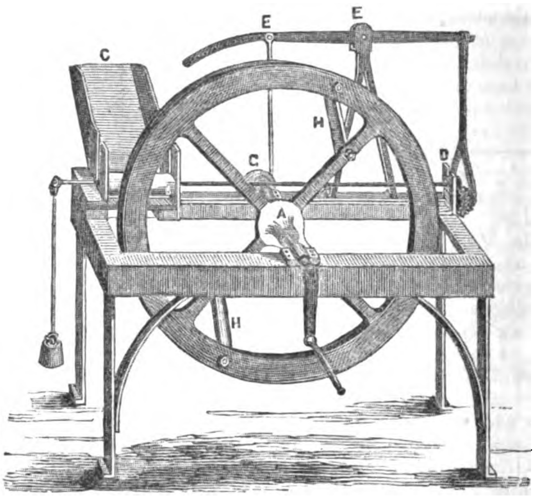
Woods claim, of course, considerable attention, whether adapted for mere ornament or national use. Among both, the Great Exhibition showed many worth employing. The red ebony, from South Africa, is likely to become a favourite wood for elegant domestic purposes, as well as the musk wood, black wood, and Huon pine, from Van Diemen's Land; while the morra and greenheart of British Guiana, and the enormous blue gum of Van Diemen's Land, are considered admirably adapted for shipbuilding.

"Even a slight examination," we are informed, no doubt correctly, "of the raw produce which forms the chief basis of our manufactures, must lead to the conclusion that, in many cases, the best substances are not used, nor are the best modes of preparing them followed." The author goes on emphatically to remark, that it is strange and startling, but nevertheless perfectly true, that, even at the present time, there are many excellent and abundant productions of nature with which not only our manufacturers, but, in some instances, our men of science, are wholly unacquainted." Old things from new localities, and new things from old localities, we must perpetually expect to see. Our travellers must go forth on their wanderings better informed on these subjects than they have been, and must look well about them when they are wandering. We would here take the liberty of suggesting to those who have the disposition of "the surplus money," that a portion of it could not be better employed than in investment in government securities, for providing a sufficient fund for the institution of travelling professors, to be nominated annually or biennially, as it might be considered expedient, for the purpose of closely and scientifically investigating the natural products of different countries (in the countries themselves), with a view to their employment in arts and manufactures *generally*. Such temporary professorships would be of immense advantage. All the world would unite to render honour to the parties appointed; and this would stimulate them to high endeavour. Such are the embassies which we would see established, not only in our own, but in every country; and the honourable position which the professorships would yield, associated with the means of refined recreation which the funds should provide, would doubtless make the office one of ambition to obtain. The "old rule-of-thumb mode" of going on will no longer do. We ought not to be dependent on mere "accident" or "chance" for our discoveries. We may make them now under a *rationale*; and why should we not? It has been proved over and over again, how much power has been lost by reinventing old inventions. Why should we not see at once what these old inventions are? We can conceive a body of professors going out from the civilized states of Europe and America, and bringing home the exact status of things in all the world. What may thus be done by all at once, may be accomplished gradually by one. Conventional non-valuables would soon be shown to possess great value. New modes of operating would almost necessarily be discovered or suggested. The Exhibition itself did this only to a small extent after all, —great, indeed, but relatively small. All our failures, rightly considered, are more instructive than successes. We must learn, in the best way we are able, what both have been. We are now on a right tack, and it behoves us to take care how we steer. The compass which is promised to us in the Museum of Industry will, we trust, itself be improved as time rolls on, until eventually we shall require no leading principle, but that which we may have acquired by progressive habit and progress within. —This discourse of Professor Solly deserves a wide circulation.

CORRESPONDENCE.

KENNEDY'S FURZE-CUTTING MACHINE.

The machine represented by the annexed perspective sketch, is designed for cutting or chopping furze, or hay and straw, in any length between $\frac{1}{8}$th and 2 inches. As the farmers find it an excellent machine, being simpler than any other, it may perhaps claim a place in the *Practical Mechanic's Journal*. It consists of a rectangular frame, supported on four legs, and carrying bearings on its upper edges for the fly-wheel shaft, A, driven by a winch handle. The furze is supplied to the feed-rollers, B, down the incline, C, the rollers being driven by a pair of horizontal shafts connected to the gearing, D. This gearing consists of a pair of pinions, one on each shaft—one of which has upon it a ratchet-wheel, capable of being worked by a double catch-rod, one catch acting in the up-stroke, and the other in the reverse way. The catch-rod is suspended from one end of an overhead lever, oscillating on a centre at E. On the other side of this centre is a link suspended at F, by an adjustable pin, and passing to an eccentric, G, on the end of the driving-shaft. The knives, H, are plain pieces of cast-steel, riveted to iron backs held by bolts on the fly-wheel. As the fly-wheel shaft revolves, the action of the eccentric, G, vibrates the lever overhead, the



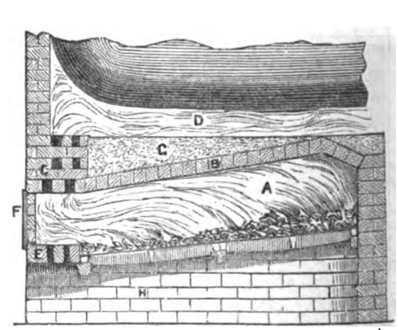
double action of which works the feed-rollers in the simple manner described.

Hanover Street Iron Works,
Cork, June, 1852.

JOHN KENNEDY.

IMPROVED FURNACE.

The idea of this form of furnace was suggested to me by observing the effect of a cold body, such as a vessel of water, held over the flame of a candle. So long as the vessel does not touch the flame, or is in such a position that perfect combustion is effected, we obtain the maximum heating effect; but the moment the cool body is brought down so low that it lowers the temperature of the flame, we not only lose an enormous amount of heat, but produce a quantity of soot, which acts as a non-conductor, in preventing the penetration of the heat to the vessel's contents. Now, from all I have seen in the construc-



tion of furnaces, so much anxiety arises for the economy of fuel, that furnace-builders enclose it in flues, or between water-spaces, thereby defeating the very end they are striving at. Again, the mere heating of the gases, without the presence of a proper supply of air, or the admission of air without taking proper means to prevent its lowering the temperature of the furnace, will not do, and this is what I have endeavoured to bear in mind in the construction of my furnace. The body of the furnace, A, is formed by an overhead arch, B, of firebrick, or other non-conducting material, a communication being formed through this arch by the openings, C, which convey the gases to the flue, D. By this contrivance, the products of combustion do not come immediately in contact with any heat-absorbing surface; and, owing to the radiation of the intensely-heated furnace, they are favourably disposed for combination with the air admitted near the door, by the small hearth, E, formed by interstices between the bricks. Besides this, the air so admitted must be thoroughly intermixed with the gases by the very nature of their motion through the interstices, and the products of combustion come towards the door, so that, when it is opened to admit fuel, there is no sweeping draught of cold air, as is usual in furnaces of the ordinary construction, where it is directly through the furnace. This is a hint which may possibly be serviceable in the construction of coke ovens, The fire-door, F, is lined with firebrick; at G is a layer of sand, and H is the ashpit. The fuel may be thrown back as far as possible, and, when coked, it may be drawn forward, and its combustion thoroughly effected.

Plymouth, June, 1852.

H. MATHIESON.

PATENT LAW AMENDMENT.

At length there appears to be a prospect of this long-looked-for reform being carried into effect, and the present session of Parliament, which was considered at its commencement as a mere waste of the time of our legislators, gives promise of being most fruitful in amendments of the different branches of our laws. Long before the issue of our next part, it is far more than probable that the new bill—a print of which we have before us—will have found a place in the statute-book, and have become law. We have received this bill too late in the month, to allow us to do more than give a brief abstract of its essential features. It is, on the whole, very similar to that which we noticed very fully last year, the clauses as to the constitution of commissioners, the provisional protection of inventions, the practice of obtaining patents, and the stamp duties and fees to be paid, being substantially the same.

In noticing the provisions of that bill, we stated that the most objectionable clauses in it, were the total exclusion of the Colonies from the grants of letters-patent, and that the publication or use of an invention in any foreign country was to be a bar to a valid patent here. Both these clauses, we are happy to say, have been struck out.

A very necessary clause has also been introduced, enabling inventors, who have made application for patents before the passing of this Act, to complete their patents on the payment of a reduced scale of fees. As it is well known that a very large number of applications for patents have been made and reported upon, the completion of the patents being delayed for the purpose of obtaining the advantages offered by the proposed changes, this clause is a most important one.

We cannot congratulate the profession of patent agents upon any diminution in respect of their trouble in passing patents, as it appears that their labours will be rather increased than otherwise. All the offices will, however, be in London, and not, as heretofore, in London, Edinburgh, and Dublin, which will very considerably simplify the present process of obtaining patents for the United Kingdom.

Should the bill be carried before the dissolution of the present Parliament, we shall give it verbatim in our next issue, our apology for doing so being its vast importance to the majority of our readers. We may add, that the bill is not intended to come into operation before the 1st of October next.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INSTITUTION OF CIVIL ENGINEERS.

May 25, 1852.

The Session was this evening terminated by a brilliant conversazione, the visitors being received by Mr. Rendel, the president, and Mr. Manby, the secretary.

In the reception saloons, which were hung with Aubusson tapestry, by Jackson and Graham, and decorated with a profusion of flowers, were Sir Edward Landseer's "Random Shot," and Ward's picture of "James II. reading the Despatch," both from the collection of Mr. Jacob Bell; Turner's "Blue Lights," with an extraordinary facsimile in coloured lithography. Around these were placed pictures by Stanfield, Haghe, Egg, Herring, Ansdell, Phillip, Wehnert, Lance, Wood, Crowley, Rothwell, Niemann, Kennedy, Winterhalter, Wilson, and Carmichael.

Sir Emerson Tennent contributed some beautiful specimens of Cevlonese and Chinese carvings; Mr. Montague, a remarkable silver plateau of Maltese filagree work; Mr. Hancock, a rich silver vase, made for Lord Ward; Messrs. Elkington, a large assortment of beautiful pieces of gold and silver plate, vases, &c.; Messrs. Copeland and Messrs. Alcock, fine collections of Parian figures and groups, china, &c., several of them designed by Alfred Crowquill, who exhibited a new statuette of "The Iron Duke" from life.

Mr. Bailey sent a remarkable life-like bust of Robert Stephenson, M.P., and the modelled design for the statue of the late George Stephenson; and specimens of sculpture by Lough, Thomas, Loft, and others, with bronze by Collus and F. Bramah, were also grouped around. Mr. Apsley Pellat sent a large collection of glass, and amidst it was placed a beautiful basket of flowers and insects electrotyped in gold and silver, by Captain Ibbetson. Mr. Gould contributed some brilliant specimens of his beautiful humming-birds, which contrasted well with three scenes of "Falconry" by Mr. Hancock, of Newcastle.

The principal room contained a numerous collection of models, many of which were shown at work. Among these may be particularly noticed the anastatic process of printing, exhibited by Messrs. Glynn and Appel, who had recently introduced a method of preparing paper by the addition to it, while still in a state of pulp, of an insoluble salt of copper, and a peculiar preparation of palm-oil, so that, when an attempt was made to reproduce any document, it became fixed to the plate, and no transfer could be made. Messrs. Napier and Son exhibited an automaton sovereign weighing-machine, which differed from those now in use at the Bank, by its separating the coin into three classes, the too light,—those between certain limits, which might be variable,—and the too heavy, instead of simply into the light and the full. They also exhibited a captain's registering compass, which showed at a glance the exact course the ship had taken, and the moment when any deviation from the true course had been made.

Mr. W. Lacon also explained a very beautiful model, illustrative of his ideas as to the management of ships' boats; how they should be steered, and suspended, and lowered in case of emergency—an important desideratum. Mr. S. Highley's achromatic gas microscope lamp—a contrivance for combining, or rather modifying, the glaring light common to ordinary gas microscopic burners when making researches—seemed to be an object of great interest.

There were also many models in various branches of engineering; Messrs. Maudslay and Messrs. Penn contributing models of almost every kind of marine engine, and to Captain Henderson was due the collection of a vast number of different kinds of vessels, for the purpose of showing the great discrepancy that existed in different countries in the lines of ships.

In railways, permanent way seemed to be the point to which inventors chiefly devoted their thoughts, and the various modifications of Mr. W. H. Barlow for a road entirely of wrought-iron, of Mr. Henson for a similar rail, supported by longitudinal timbers, and of Messrs. P. W. Barlow, Greaves, Doull, and Reed, for chairs and supports of cast-iron, so as to make the road partly of cast, and partly of wrought, but still entirely of iron, were shown. Mr. Henson also contributed a beautiful model of his covered railway goods waggon, by which it was said a saving of at least fifty per cent. in repairs alone, over the old waggons with sheets, would be effected.

The centre table was devoted to an assortment of every description of fire-arms, from the old Indian and Chinese matchlocks, some of which even were revolvers, down to the Minié rifle, the Colt revolver, and the Lancaster smooth-bored rifle. There were also numerous applications of Mr. Hodges' cumulators, a new mechanical power obtained by the accumulation of elastic force, as well as Mr. Appolds' arrangement for showing water below 20 degrees without freezing.

In the ante-room, Mr. Goddard, of Ipswich, explained a gas cooking-stove, and an asbestos fire, in lieu of that formerly produced by platinum, and there was also a combined gas stove, by Mr. N. Defries. On the mantel-piece was one of Mr. Bain's electric clocks, with the most recent modifications, all the power being contained in vases.

An elegant mantel-piece of Llangollen slate stone, showed the capability of that material for receiving the highest polish, and by the new process of imitating marble, the very beautiful workmanship which might be had for a small cost.

The rooms were again thrown open on the following day, to allow the ladies to examine the various objects of interest at their leisure.

ROYAL INSTITUTION.

Wednesday, March 31.

Sir Charles Lemon, Bart., M.P., F.R.S., in the Chair.

This was an extra evening, set apart for the purpose of hearing M. P. H. Boutigny (D'Evreux), on some further researches upon bodies in a spheroidal state. After remarking that the simple phenomena of the subject would seem to have necessarily attracted attention from the most ancient times, and endeavouring to discover some record of the fact, he had found the possible expression of it in the Wisdom of Solomon, c. xix. v. 20—"The fire had power in the water, forgetting his own virtue; and the water forgat his own quenching nature." Eller and Leidenfrost, however, about the middle of the last century, first truly observed the simple phenomena; but nothing had since been done, either to increase our knowledge of the singular facts, or to suggest an explanatory theory concerning them. Every one has observed, that when a metal disc, slightly concave, is heated in the fire or over a lamp, and a few drops of water are thrown upon it, the water assumes a spheroidal form. This is the simplest experiment, and forms the point of departure upon all researches into the subject. If we place a few drops of water upon a metal disc, slightly concave, and then submit it to the heat of a spirit lamp, ebullition and dissipation of the contents, in steam, follow in the ordinary course. But if we continue to elevate the temperature of the disc to about 142°, the water ceases to adhere to the disc, and appears to fall back upon itself, in taking a very flatted spheroidal form. Its temperature, which was before at 100°, is suddenly reduced to $+100°-x$, and remains at this heat, whatever effort we may make to increase it. Evaporation, far from being increased by the increase of the surrounding temperature, becomes greatly diminished. The water finally assumes the appearance of regular waves in the spheroid, which often presents a completely stellar appearance, offering the greatest analogy to those produced by sonorous bodies when put in a state of vibration. M. Boutigny then exhibited the experiments which he had recently made. He placed some nitrate of ammonia, which is inflammable at a very low temperature, upon a capsule of platina, greatly heated, but it assumed the spheroidal condition without ignition. On removing the lamp, however, and when the substance was cooled down to the ordinary temperature, it ignited. The beautiful violet-coloured vapour of iodine was produced also in the same manner, as also distilled water, which passed into steam as soon as the metal disc was sufficiently cooled. He then proceeded, by experiment, to show how the fact as relates to water readily explains the occasional bursting of steam-boilers, when, by the cooling of the boiler after the introduction of water into it when overheated, the contents are immediately and violently converted into steam.

The singular fact of the universal decrease of temperature in the liquid, when in a spheroidal state, was then adverted to. Numerous experiments had proved it. This phenomena has given a result wholly unforeseen and most remarkable. The chemist knows that liquid anhydrous sulphurous acid boils at a very low temperature. M. Boutigny, in submitting this acid to similar conditions in a slightly humid atmosphere, the acid first took an opaline appearance, then lost its transparence, and finally solidified. The solid formed was ice! As a variation of this experiment, some drops of water were thrown upon the acid while in the spheroidal state, and the water

immediately congealed. In order to demonstrate that liquids, when in this state, do not touch the surface of the metal, some concentrated nitric acid was dealt with, but it did not act upon the copper disc on which the experiment was made until the copper was cooled. A cylinder of silver, at a white heat, was also plunged into water; it was distinctly observed for many seconds (the room being darkened) not to be affected by the surrounding medium. The lecturer then insisted that it was not alone to such physical results that we are to look on the curious phenomena he has unvailed, but to the new method of chemical analyses and synthesis which they suggest. He has thus found that some bodies, which are not decomposed at boiling heat, are so when put in a spheroidal state; while others, placed in contact under the influence of this new molecular state, produce new combinations. When wine and alcohol are in a spheroidal state, their elements are found to be in a new order; ether is decomposed, and disengages aldehyde; chloride of ethyle decomposes nitrate of silver; ammonia dissolves iodine, &c. To the diminished temperature of bodies in this state, the lecturer ascribes the ability of conjurers to perform their feats of putting their bare arms in melted metal, &c.; and exemplified with what simplicity this may be done, by performing the experiment of himself manipulating some melted lead. To render the experiment harmless, it is only necessary that the part exposed to the metal should be slightly moist. M. Boutigny concluded with a suggestion, that, as water only evaporates from its surface, the generation of steam in boilers might greatly be increased by placing metal diaphragms, pierced in small holes, across the inside of boilers. The evaporating power of a boiler, constructed on this principle, in comparison with one of the common construction, is as 4 to 1, with all the advantages attending the impossibility of explosion.

Friday, April 30.

Wm. Richard Hamilton, Esq., F.R.S., F.S.A., V.P., in the Chair.

Thomas H. Huxley, Esq., R.N., delivered a discourse upon "Animal Individuality," in which he attempted to maintain the definition of an individual as the sum of the phenomena presented by a single life; in other words, as all those animal forms which proceed from a single egg, taken together, whether represented by (1.) successive inseparable forms; or (2.) by successive separable forms; or (3.) by successive and co-existent separable forms.

Friday, May 7.

W. R. Grove, Esq., M.A., F.R.S., V.P., in the Chair.

Professor Edward Forbes, F.R.S., "On the supposed analogy between the life of an individual and the duration of a species." This lecture would not be intelligible without the diagrams which the lecturer referred to; and scarcely even then, unless the reader had been present at the discourses which, for the last three or four years, have been delivered by Mr. Forbes in the same place.

Friday, May 14.

Sir Charles Fellows, V.P., in the Chair.

The Rev. Edward Sidney, "On the rise of the Sap in Spring."

SOCIETY OF ARTS.

Wednesday, March 31.

His Royal Highness Prince Albert, K.G., President, in the Chair.

Mr. Bazley, President of the Chamber of Commerce, Manchester, delivered his lecture on "Cotton, as an Element of Industry; its confined supply, and its extending consumption by increasing and improving agencies." The speaker proposed to consider the subject under two heads:—1st, Treating of the progress of the manufacture; and, 2dly, Of the sources whence the raw material is supplied. After adverting to its early history, and to the great step which had been made by the introduction of steam power to supersede the slow and tedious duty performed by beasts of burden, or wind, or water, he referred to the other great general step made in the formation of canals, superseding the old pack-horse and waggon. Upon this point the lecturer paid a just tribute to Lancashire, in which county the first successful canal and railway were formed, and the advantages of gas were first tested on a large scale. At the commencement of the last century, only about 1,000,000 lbs. weight of cotton-wool was consumed per annum, giving employment to but 25,000 people; while, at the close of the century, about 125,000 was the number employed, and 52 millions per annum was the consumption. The increased importance of the manufacture at the present day may be estimated by the fact, of 760 millions of lbs. weight of raw material having been used during the past year, and this quantity having gone through the hands of no fewer than three millions and a half of our fellow-subjects—an eighth of the population of the United Kingdom; while the exports in 1851 amounted to 30 millions sterling. Mr. Bazley also mentioned the significant fact, that 12 millions sterling, or about one-fourth of the whole revenue, is contributed in taxes by those engaged in the manufacture. Individuals are living who recollect the first supplies of the raw material from America (whence 84 per cent. of that used is now obtained) in 1787.

The amazing productiveness of the plant may be estimated from the fact, that a piece of ground of the size of Yorkshire is sufficient to produce a quantity of cotton nearly double the annual consumption of England. As the manufacture is still greatly increasing, it would seem to be our duty to endeavour to make our colonies exporters of the raw material to a far greater extent than they now are; and efforts are beginning to be made towards this desirable end.

Wednesday, April 7.

Josh. Glynn, Esq., in the Chair.

S. H. Blackwell, Esq., of Dudley, F.G.S., delivered a discourse "On the Iron-making resources of the kingdom, and the first process in Iron-making."

The lecture commenced with a graceful reference to the Crystal Palace, which had brought so prominently into notice the great iron-making resources of the kingdom, and the extraordinary perfection to which some of the branches of that manufacture had attained, while it illustrated no less how those resources underlie all the departments of our manufactures, and form the basis on which all progress must rest.

The history of the iron trade may be divided into two periods—the first, terminating at 1740, when coal was introduced as fuel for smelting; the second, extending to the present time.

In 1615 there were in the whole kingdom 800 furnaces, yielding 180,000 tons; and in 1740 these had declined to 59 furnaces, producing 17,350 tons. At this period coal was introduced, and the rise was thenceforward rapid; in 1788, 70,000 tons; in 1800, 180,000; in 1825, 600,000; and in 1851, 2,500,000. In the same year, the exports of pig-iron were upwards of 1,200,000 tons, besides tin plates, hardware, cutlery, and machinery, bearing a total value of £10,424,139.

The causes of this wonderful increase are mainly three—the rapid expansion of our arts and manufactures; the improvements in machinery; but, above all, the vast supplies of coal and iron contained in our mineral fields, and their happy proximity to each other, by which the ore and the coal for its smelting are obtained from the same working.

A class of ores is likely to prove so important, that some notice of it must be given. It commences on the north-east coast of England, at the river Tees, and, stretching through York, Lincoln, Northampton, Oxford, and Dorset shires, is at Lyme-Regis diverted by the granite formations of Devon. Its discovery was first made at Middlesboro', between two and three years ago, where the bed is fifteen feet thick, and contains thirty per cent. of iron; and so low is the cost of its production, that the manufacturers of that district have been enabled to compete with the maker of iron from the Scotch black bands. Some idea of the extent to which this bed will ultimately be worked, may be gathered from the fact, that although the workings have been so recently commenced, 200,000 tons of stone were raised by one firm alone in the course of the past year. This ore differs in appearance and structure from any other, and on this and other accounts, although the existence of the bed in Northamptonshire had been long known, and traces of the ancient workings were to be found, it had been neglected, and it was only by the Exhibition that its extent and value had been ascertained. The supply of this ironstone may be fairly considered as inexhaustible—that from Higham-Ferrers, in Northamptonshire, where many tracings of ancient workings have been found, yielding 55 per cent of iron.

The lecturer then proceeded to notice the improvements in the manufacture, by which, in little more than a century, a larger quantity is now produced by two furnaces than by the whole number in blast in 1740, while, by several single firms, fivefold the whole make of the kingdom at that period is produced.

The reduction in prices resulting from these improvements has naturally been very great, and pig-iron has now fallen from £8 per ton, the average in 1820, to £2. 12s. 6d. It is not uninstructive to remark, that the quantity exported in the past year, with the duty on foreign iron at 30s., is double the entire make of the kingdom in 1825, when the duty was reduced from £6. 10s.

Not the least interesting part of this important history, is the consideration of the obstacles opposed by prejudice and ignorance to each successive improvement. Although the use of coal was attempted as early as 1620, the opposition on the part of the workmen was such, that its successful application did not take place till more than a century later. For a long time the most eminent firms refused to make use of the hot-blast, although now more than 19-20ths of the whole produce of the country are made with it; and the application of the waste gases, although adopted most successfully in Scotland, Derbyshire, and South Wales, has hitherto failed to make its way into South Staffordshire.

An important result of the Exhibition is the acquaintance it has given us with the iron manufactures of other countries, which, in many cases, showed an excellence which we have not yet attained, but which we must reach if our preeminence is to be maintained. It is a dangerous mistake to suppose that we are possessed of any exclusive skill in manufacture, or that our immense natural advantages will enable us to retain the position which we hold without straining every nerve to do so. The lecturer concluded by warning the Anglo-Saxon race, "to whom work is less a toil than a passion," that with their faculties and natural privileges, they also bear the responsibility of the progress of the world.

Wednesday, April 14.

Apsley Pellatt, Esq., in the Chair.

Mr. George Shaw, Professor of Chemistry at Queen's College, Birmingham, delivered a lecture "On the Glass Manufacture." He commenced with a general definition of glass, as a combination of silicic or boracic acid with the oxides of some light metals, as potassium and sodium, and of some heavy metals, as lead, the combination being effected by heat, and the result a transparent substance of non-crystalline structure. It is by the admixture of these various silicates that the different kinds of glass are obtained; crown or window glass, for example, being composed of silicic acid and potass; while flint glass, of which our usual domestic articles are made, contains silicate of lead; and enamel, in addition to these, oxide of tin or antimony. An intelligent study of the silicates is necessary to excellence of manufacture; since, for example, if too much potash be used, the glass containing it will be to a certain degree decomposed by the action of air and

water; while, on the other hand, the fusibility and softness necessary for the moulding and cutting of flint glass is obtained by the admixture of lead in a greater or less degree.

Silicic acid is used by the glassmaker in the form of sand, and in the American department of the Exhibition a fine sample of such sand was shown.

Mr. Shaw then described the several processes of manufacture, from the fusing of the materials to the ultimate annealing of the finished article; noticing, in connection with the latter, the beautiful optical test of the completeness of that operation, which depends on the different degrees of double refraction possessed by glass in different states of its structure.

The various contributions in the Exhibition, in illustration of the present state of the manufacture of glazing glass, were spoken of as bearing testimony to the fact, that the general nature of the manufacture remains unchanged; the immense superiority of the products of the present day over those of the 12th century being the result of the accumulation of almost imperceptible improvements in the various stages. The methods in use are two—flashing and spreading; the former possessing the better surface, but the latter the more uniform thickness. Amongst the glass of these two kinds, the productions of Messrs. Chance were said to stand pre-eminent for their extent and general excellence; and particular mention was made of their patent plate, and of those *nests* of shades, which are in the recollection of all our readers. Messrs. Hartley's series, illustrative of the manufacture, was also noticed with high praise.

In flint glass, Oslers' fountain claimed first mention, as the most astonishing product in the whole range of the manufacture, and as a type of a method of construction introduced by those gentlemen, and likely to be much employed. The lecturer then went minutely into the processes of moulding, pressing, and cutting, while he noticed the exhibited productions of Richardson, Pellatt, Lloyd, and Summerfield, Bacchus, and others, as illustrations of every attainable excellence in those processes: and he completed his notice of the colourless glass of the Exhibition, by describing the optical glass shown by Messrs. Chance, and the enormous difficulties to be overcome before uniformity could be obtained in such large masses of crown glass.

Attention was next drawn to the coloured glass used in windows, the details of the manufacture of which, with the various methods of obtaining colour, and of producing effects, were clearly given; which led to an interesting exposition of the principles which should guide designers in stained glass; in the course of which Mr. Shaw enunciated a canon of criticism, with which this brief abstract may fitly close,—"that in the application of any material to decorative purposes, those properties which are peculiar to the substance should be made especially prominent."

Wednesday, April 21.

Mr. Digby Wyatt made his "attempt to define the principles which should determine form in the Decorative Arts." From the important and peculiar character of this excellent discourse, it is impossible, in a condensed report, to convey anything of profit to our readers. We will merely mention at present, that, in the opinion of the lecturer, four principal elements concur in the production of emotions of delight, testifying the presence of beauty in the arts. These are variety, fitness, simplicity, and contrast. Mr. Wyatt proceeded to point out the bearing of these elementary principles on the leading arts—namely, architecture, sculpture, metal-work, furniture, glass, earthenware, and surface decoration. We shall hope at a future time to give, by a review of the lecture, when published, a more definite idea of this communication.

Thursday, April 22.

Harry Cole, Esq., C.B., in the Chair.

Mr. Edmund Potter, the well-known calico-printer of Manchester, read a paper on that branch of manufacture. After tracing the history of the subject in England from the end of the seventeenth century to its present position, when our annual home consumption equals four millions and a half of pieces, and our exports have reached fifteen millions and a half of pieces, he alluded to the great impulse given by the invention of the cylinder printing machine, by Bell, in 1788, from which time the rise in production had been rapid. The tax, which was removed in 1831, had been a serious obstacle to production; and the astonishing result just mentioned had, no doubt, been brought about, in a great measure, by the removal of this burthen. Hand-blocks are still used in the trade; and a shawl was exhibited which had, by these means, received more than 1300 impressions. Mr. Potter divided the exports into "low" and "fine" prints, —the former amounting to six and a half millions of pieces, or 40 per cent. of the whole. The "low" goods are principally exported to India, South America, Turkey, China, and the African coast. To the United States, our exports are confined to the "fine" kinds. Several interesting deductions were made by the lecturer in the course of the evening—one of these being, that our capital, energy, and ingenuity, in the contrivance of machinery, have enabled us to appropriate branches of trade which originated in other countries. This is eminently the case with regard to the mousselines de laine, which were of French invention, but are now made in immense quantity here.

Wednesday, April 28.

Mr. Owen Jones delivered his discourse "On the principles which should regulate the employment of colour in the Decorative Arts, with a few words on the necessity for an architectural education on the part of the public." After adverting to the low state of art in England, in comparison with other countries of Europe, and as regards them in comparison with the nations of the East, the lecturer pointed out the historical fact, that, in all ages, except our own, there had existed a unity between architecture and the arts, with which it is related. Here the architect, the house painter, the upholsterer, the paper-stainer, the calico-printer, and the weaver, acted independently of one another. The disorder resulting from this has been productive of many incongruities. Mr. Jones then rapidly explained a series of twenty-two propositions which he had framed, after study, partly of the works of nature, partly from the teachings of science, and partly from hints furnished by the practice of those nations which had excelled others in the decorative arts. He concluded by observing at some length upon the absence in England of the regular discipline of the artists, and by suggesting some important measures likely to promote this end.

INSTITUTION OF MECHANICAL ENGINEERS.

October 25, 1851.

"Siemens' Regenerative Condenser,"—(continued from page 214, Vol. IV.)

The chief advantages obtained by the application of this condenser to the low-pressure engine are:—

1. The requisite amount of injection-water is reduced in the proportion of 3 to 1.
2. The feed-water of the boiler is obtained nearly boiling hot, which constitutes a saving in fuel of $\frac{210 - 110}{1960}$ about 10 per cent.
3. The whole amount of heat generated under the boiler is given off by the engine in form of water at 210° Fahr., which, in most cases, may be advantageously employed for heating buildings, for washing, dyeing, and other purposes.
4. A large proportion of the power required for working the air-pump is saved.

The first regenerative condenser was attached to a 16 h.p. high-pressure engine, at Saltley Works, near Birmingham, in September, 1849, where it has been found to answer, although it is not perfect in its proportions, and could not be kept constantly in operation, in consequence of a deficiency of injection-water.

The author proposes to conclude this paper with a short historic sketch of the steam-engine condenser, to illustrate the distinct features of this proposed system.

In Newcomen's engine, the condensation of the steam was effected by the alternate introduction of a jet of cold water into the steam cylinder itself. The cold water naturally cooled the walls of the cylinder, which in their turn condensed a large portion of the succeeding charge of steam before it had forced the piston upward.

James Watt, in seeking a remedy against this loss of heat, conceived the possibility of condensing the steam in a separate closed vessel; and, in carrying his idea into effect, he not only realised his immediate object, but at the same time rendered the steam-engine susceptible of that degree of perfection and general application of which it is now possessed. The injection condenser of Watt is the most effectual of its kind, and has maintained its exclusive dominion to the present day. It consists of a closed vessel, which communicates periodically with the steam cylinder. The injection-water, together with the condensed steam and air, which is partly evolved from the injection-water, and partly leaks in through the joints of the cylinder and the exhaust pipe, are continually discharged from it by means of the air-pump. Shortly after the introduction of Watt's condenser, a surface condenser was proposed by Hornblower, which consisted of a close annular vessel of thin metal plate, on the inner surfaces whereof the waste steam of the engine was condensed; its latent heat being continually carried off by a stream of cold water which surrounded the vessel. A comparatively small air-pump was provided, which served to discharge the condensed water (to be again forced into the boiler), and some air which might leak in through the joints.

This condenser failed in practice, for want of sufficient extent of cooling surface. An effective surface condenser would possess considerable advantages over the injection condenser, especially in the case of marine engines. Allowing the condensed steam to be continually returned into the boiler, it prevents incrustation of the latter, and, moreover, dispenses with the necessity of blowing off. Its air-pump absorbs a much smaller proportion of the power of the engine, and its functions require less personal attention. Stimulated by these considerations, several attempts were made to improve on Hornblower's invention, but since all these improvements partake very much of the same character, it is thought sufficient for the present purpose to mention only Hall's condenser, which has obtained the greatest amount of notoriety. It consists of two flat chests, or close chambers, which are connected together by means of a large number of brass tubes, through which the condensing steam circulates. These tubes are surrounded by cold water, which fills up the space between the flat chests. A small air-pump removes the condensed water and air from the lower chest. The great weight and costliness of this condenser, its liability to derangement, and the impossibility of removing the calcareous deposit of the water from the tubes, without taking the whole fabric to pieces, are found to be heavy practical objections.

In the year 1847, the author had occasion to apply a surface condenser, in a situation where economy of space and material were essential. In considering the most rational distribution of surfaces, he happened to find an arrangement which, with less than one-half the amount of material used in Hall's condenser, produced a very satisfactory result, and which paved the way to the more important improvement which forms the principal subject of this paper.

The surface condenser referred to, consists of a number of copper plates, of $\frac{3}{32}$ inch thickness, and about $4\frac{1}{2}$ inches broad, by 2 feet long, which are fixed together by two longitudinal flattened wires of the same metal, between the adjacent plates; and the whole pile is screwed up tight together between the sides of a rectangular cast-iron vessel, which constitutes the body of the condenser. The ends of the plates project through the top and bottom of the condenser, and are planed flush with its exterior surfaces. The joints at top and bottom are secured by means of india-rubber rings, which are screwed down under small cast-iron frames, and yield to the difference of expansion between the two metals. The flattened wires are laid parallel, about three inches apart from each other, and form, with the

plates, a large number of narrow passages, through which the cold condensing water flows in an upward direction, without entering the vacuous space of the condenser, into which the edges of the plates outside of the flattened wires project, forming the condensing surfaces.

The *rationale* of this condenser is as follows:—

The transmission of heat in a surface condenser is threefold.

1. From the condensing steam to the internal metal surfaces.

2. From the internal surfaces, through the body of the metal, to its external surfaces.

3. From the external surfaces to the surrounding water by which it is carried off.

The first-named operation (condensation) would, it is presumed, proceed with undefined rapidity, if it were not retarded by the second and third, or by the presence of some permanent gases, which accumulate on the condensing surfaces, and prevent their immediate contact with the steam. The second (conduction) varies in direct proportion with the conducting power of the metal, and with its thickness; but the conducting power of copper is so great, that its thickness seems to exercise no appreciable influence on the amount of heat transmitted in a given time. This interesting fact is proved by Dr. Ure's experiment with two copper pans, of the same internal area, but of very unequal thicknesses of bottom, (being in proportion as 1 to 12,) which were both filled with water, and dipped into a hot solution of muriate of lime. It was found that the water in the thick pan evaporated the quickest, which may be accounted for by its slightly increased external surface in contact with the heating solution; and this affords additional evidence that the limit of transmission does not lie within the metal, but rather between the metal surface and the liquid. That the absorption of the heat by the water is a slow process, may be inferred from the circumstance, that water, although possessing a large capacity for heat, is a very bad conductor, and depends for its power to absorb heat on the slow circulation over the heating surface, caused by the inferior specific gravity of the heated particles of water. A strong artificial current along the heating surfaces greatly accelerates the process.

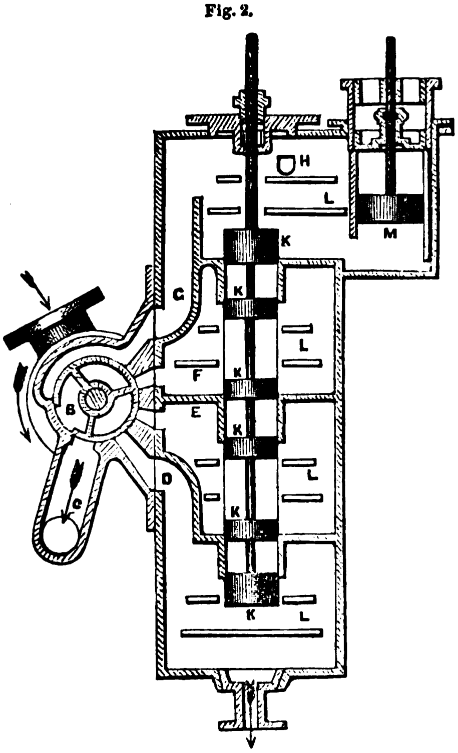
The surface condenser, above described, was arranged in accordance with these observations.

It contains:—Heat-absorbing surfaces, (by the water,) 18 square feet per horse power; condensing surfaces, 9 square feet per horse power; computed mean thickness of metal through which the heat is transmitted, $1\frac{1}{4}$ inch; weight of copper, 60 lbs. per horse power; space occupied by plates, 0.4 cubic feet per horse power; about one-tenth part of the space occupied by the tubes in the tubular condenser.

The essential features of this condenser are, its comparative cheapness of construction, and the easy access which it affords to the water-channels between the plates.

It also requires less condensing water than previous surface condensers, in consequence of the repeated and close contact in which each particle is brought with the heating surfaces, before it can reach the upper reservoir, or hot-well. The author considers that the surface condenser just described may be advantageously applied to marine engines, and not being subject to a patent, he hopes it will receive a sufficient trial.

Fig. 2.



Being required to save the waste steam of a low-pressure engine, in the form of slightly heated water, by Mr. John Graham, of Manchester, the author, in the spring of 1847, conceived the idea of a regenerative condenser. His first arrangement may be termed a regenerative surface condenser. It consists of a revolving valve, which admits the waste steam of the engine first to the atmosphere, and, successively, into separate compartments, where it is condensed at various densities. The cold water first passes between the plates within the last compartment, and by degrees through those within the first compartment, where the steam is of nearly atmospheric pressure, and consequently heats the water to nearly 212° Fahrenheit, when it passes out.

The next step was an injection condenser, on the same principle as represented in fig. 2.

The revolving valve, B, admits the waste steam of the engine, first to the atmosphere at C, and then successively into the separate compartments, D, E, F, G, where it is condensed at various densities. The cold water is injected at H, and is passed down through the steam in each compartment in succession, by means of the displacing pistons, K K, which work all on the same piston-rod through each of the divisions between the compartments; and the heated water passes out at the bottom, at I.

L L, Are overflowing distributing-trays, for the purpose of bringing the water more rapidly and completely in contact with the steam. M, Is a small pump to extract the air that is mixed with the steam and water.

The regenerative condenser, in its present form, partakes of the nature of both the surface and injection condensers.

Attempts have been made, from time to time, to condense the steam of a high-pressure engine, without the aid of an air-pump, by blowing the steam into a small injection condenser, which is provided with a large exhaust valve.

It is clear that the steam of high pressure will, at first, partially blow through the condenser, and rid it of its air and condensing water, and that, by degrees, the jet of cold water will overpower the influx of steam, and consequently produce a vacuum. An arrangement of this description, although simple, is at least very imperfect, because it is a matter of considerable difficulty so to proportion the injection of cold water, that the first rush of steam is not forthwith condensed, but may exert its expansive force in a cold vessel, and yet, an instant afterwards, effect a complete condensation of the remaining steam.

If too much water be used, the air and water will not be expelled, and consequently no vacuum be formed; if too little, no final condensation will take place.

The quantity of injection-water must be very large, because the whole of the steam has to be condensed; and having to complete the condensation in the same vessel, it must leave it at a low temperature.

The principle of the regenerative condenser has been carried still further in the regenerative engine, which has been executed on a large scale by Messrs. Fox, Henderson, & Co., under the superintendence of the author. In it, the steam, after it has served to propel the working piston to the end of its stroke, is received into a series of consecutive chambers, from which it returns to the working cylinder an indefinite number of times.

TABLE OF THE PRESSURE OF THE VAPOUR OF WATER, FROM THE FREEZING TO THE BOILING POINT.

Temperature, Fahr.	Pressure. Inches Mercury.	Temperature. Fahr.	Pressure. Inches Mercury.
32	0·20	130	4·34
40	0·26	140	5·74
50	0·37	150	7·42
60	0·52	160	9·46
70	0·72	170	12·13
80	1·00	180	15·15
90	1·36	190	19·00
100	1·86	200	23·64
110	2·53	210	28·34
120	3·33	220	30·00

"On the Preservation of Timber by Creosote," by Mr. J. E. Clift.

In the present day, when the requirements for timber, in the various mining, engineering, and other works, are so great, it becomes necessary to consider carefully the best means of rendering it as durable as possible, and that at the least expense; and the writer cannot think that sufficient attention has been paid to the subject by the parties most interested, from the fact that but few of the larger consumers of that article have adopted any plans for its preservation; and this fact must be the apology for bringing before the Institution a paper upon a process which has been partially in use for several years.

In looking through the colliery districts, it is found that thousands of loads of timber are taken green from the forests and used every year; and the greater portion is used in the pits, where, owing to damp atmosphere and increased temperature, it is rotted in a few months: whereas, with a small expense, it might be made to last for years.

It may be observed, also, that the railway engineers are seeking for a more durable bearing for the rails in iron sleepers, and overlooking the means of making wood, which is allowed to be the most agreeable for travelling upon, the most durable as well as the most economical material for the permanent way.

Wood may be briefly stated to be composed of a fibrous tissue, which, upon examination with the microscope, is found to consist of longitudinal tubes, arranged in concentric rings around the centre pith; these tubes varying in diameter from $\frac{1}{1000}$th to $\frac{1}{100}$th part of an inch. The use of these tubes in a growing tree is to convey the sap from the root to the branches; and after the tree is cut up for use, they contain the chief constituent of the sap, vegetable albumen—a substance very much resembling in its composition animal albumen, or the white of an egg. Different woods vary in the proportion which they contain of this substance, but in the softer woods it averages one per cent.

The dry rot in timber is caused by the putrefaction of the vegetable albumen, to which change there is a great tendency; and when once this has taken place, it soon infects the woody fibre, inducing decomposition, and causing its entire destruction.

Many plans have been proposed to arrest this evil, each with more or less success; the chief aim of the authors being to coagulate the albumen by means of

metallic salts, and so prevent putrefaction. Among others may be mentioned the following, as being the most successful:—Kyan's process, by the use of chloride of mercury; Burnett's, by chloride of zinc; and Payne's, by sulphate of iron and muriate of lime, forming an insoluble precipitate in the pores of the wood. To each of these plans there are serious objections in practice. In the first place, when metallic salts are injected into timber in sufficient quantities to crystallize, the crystals force open the pores, causing a disruption of the fibre; and when the timber afterwards becomes wet, they dissolve, leaving large spaces for the lodgment of water, and rendering the timber much weaker. Secondly, the metallic salts being incapable of sealing the pores of the wood, the fibre is still exposed to the action called eremacausis, a process of oxidation, after the albumen has been precipitated. These processes are also objectionable for wood that requires iron inserted in or attached to it, as the acids act upon the iron in a manner well known, and ultimately destroy it.

The plan that is the subject of the present paper is the one invented by Mr. Bethell, for the use of a material obtained by the distillation of coal tar. This material consists of a series of bituminous oils, combined with a portion of creosote; this latter substance being acknowledged to possess the most powerful antiseptic properties. The action of this material may be thus described:—When injected into a piece of wood, the creosote coagulates the albumen, thus preventing the putrefactive decomposition, and the bituminous oils enter the whole of the capillary tubes, encasing the woody fibre as with a shield, and closing up the whole of the pores, so as entirely to exclude both water and air; and these bituminous oils being insoluble in water, and unaffected by air, renders the process applicable to any situation. So little is this oil affected by atmospheric change, that the writer has seen wrought-iron pipes that had merely been painted over with it, and laid in a light ground one foot beneath the surface, taken up after twenty years, and they appeared and smelt then as fresh as when first laid down.

By using these bituminous oils, the most inferior timber, and that which would otherwise soonest decay, from being more porous and containing more sap, or being cut too young or at the wrong season, is rendered the most durable. This will be readily understood, when it is considered that this porous wood will absorb a larger portion of the preserving material than the more close and hard woods: in fact, the soft woods are rendered hard by this process. By this means, therefore, engineers will be enabled to use a cheaper timber with greater advantage, than they could use a more expensive timber uncreosoted;—thus, taking the cost of a sleeper of American yellow pine at 4s., and one of Scotch fir at 3s., and then adding 1s. to the latter for creosoting, the two would be the same cost; but the former one would last, under the most favourable circumstances, not more than ten or twelve years, and the other would be good under any circumstances, in all probability, in a hundred years.

This system of preserving timber has been in use on several railways and other works, for several years past. A portion of the London and North-Western Railway, about seventeen miles in length, has been laid with the creosoted sleepers from nine to eleven years, during which period the engineer reports that no instance has occurred in which any decay has been detected in them, and they continue quite as sound as when first put down. On the Stockton and Darlington Railway, creosoted sleepers have also been laid for ten years, and are found to continue without any appearance of change or decay; also on the Lancashire and Yorkshire Railway, creosoted timber has been used for five years, as paving blocks, posts, &c.: the upper part becomes very hard, and the part underground appears as fresh as when taken out of the creosote tank, though the timber was of inferior, sappy quality. In a trial commenced twelve years since, by Mr. Price of Gloucester, of the comparative durability of timber in the covers of a melon-pit, where it was exposed constantly to the combined action of decomposing matter and the atmosphere—the unprepared timber became decayed in one year, and required replacing in a few years; a portion of the timber that had been kyanised lasted well for about seven years, but then gradually, though very slowly, became quite decayed; but the timber that had been creosoted, still continues as sound as when first put down, twelve years since.

From these facts, it appears not unreasonable to infer, that if timber be made to continue unchanged, and to show no symptom of decay for ten or twelve years, under circumstances that reduce unprepared timber to dust in two years, and in the absence of any proof to the contrary, we may expect to find that it will last an unlimited period, and that one hundred years will be a moderate life to assign to it.

And not only does this creosoting process render wood free from decay, but it also preserves it from the attacks of the teredo worm, when used for ship-building, harbours, docks, and other work contiguous to the sea.

This has been satisfactorily proved at Lowestoft harbour, where the plan has had a very extensive trial for four years; and the superintendent reports that there is no instance whatever of an uncreosoted pile being sound, they are all attacked by the limnoria and the teredo to a very great extent, and the piles in some instances are eaten through; but there is no instance whatever of a creosoted pile being touched, either by the teredo or the limnoria, and all the creosoted piles are quite sound, though covered with vegetation, which generally attracts the teredo. This extraordinary fact is to be accounted for by the creosote remaining intact in the timber, either wet or dry; and, being destructive to all animal life, is proof against the attack of these parasites; whereas, with the other processes, the metallic salts are washed out, or that portion which unites with and coagulates the albumen is rendered quite innocuous by the process. It will be seen by the specimens exhibited, that the ravages of the worm reduce the unprepared timber to a completely honeycombed state in two years, but the creosoted timber remains untouched after a period of four years.

There are two processes in use by Mr. Bethell, for impregnating timber with creosote: one is by placing the wood in a strong iron cylinder, and exhausting the air from it by an air-pump, until a vacuum is created, equal to about 12 pounds on the square inch; the creosote is then allowed to flow into the cylinder, and afterwards a pressure is put upon the creosote; by a force-pump, equal to about 150 pounds on the square inch; the timber then taken out is fit for use.

MONTHLY NOTES.

Exhibition of Practical Art.—The articles of ornamental art, selected from the Great Exhibition, and purchased by the Government, are open to inspection by the public in the upper rooms of Marlborough House. It is satisfactory to see the selection; however, many of the objects cannot be properly viewed in the dull locality assigned to them. A nice eye and rather a severe taste have combined to render the articles destined to form the nucleus of so important a new school, of more than ordinary attractiveness and interest; and it is gratifying to learn that great numbers of persons are enjoying the treat which a visit to the rooms afforded to ourselves. Greatly surpassing all others are the things purchased from the Indian Collection. The variety and beauty of the patterns (particularly of the textile fabrics) are extraordinary. No doubt, most of these patterns are stereotyped, as it were, from ancient times: but, whether so or not, the elegance and chasteness which are manifested in their production portray incomparable artistic power. Europe has nothing to surpass this form of Eastern industry; and only here and there, in some choice *morceau*, does she appear to equal it. It is really quite agreeable to observe again, and more so, collected as the best things have thus been together, the gracefulness of line and the harmony of colouring which claimed so considerable a share of attention in Hyde Park. There are about 250 different specimens exhibited altogether, the purchase of which cost the Treasury £4,217. 1s. 5d., leaving the remainder of the £5,000 this year, limited to be expended for the purpose, to be appropriated in other ways, or as a reserve. Although each article has something recommendable in it, we cannot separately notice all. We must, therefore, content ourselves with mentioning a few only; and we the less regret being compelled to do this, as we are describing a continuing museum:—No. 52. Shawl, manufactured by Ducké Aine et Cie, 1 Rue des Petits Peres, Paris (for which £60 was paid), is said to be the most perfect specimen of shawl-weaving ever yet produced. There are 110 threads to the "centimetre" in the weft, and 210 in the warp. It is modelled on the principle of the Cashmere shawls, and in this respect only may it be said to be faulty. The harmonious effect of the blended colouring is charming.—67. Is a Sword, with enamelled hilt, point, and scabbard, manufactured at Kotah in Rajpootana (for which 50 guineas were paid), of most perfect design, arrangement of form, and harmony of colour. Centuries of refined study and experience alone seem to have been capable of adapting, so perfectly, ornament to an object to be ornamented. The lines of the ornament are introduced so perfectly, that they appear to suggest the general form rather than to have been suggested by it.—73. Comprises saddle-cloth, bridle, crupper, and accoutrements for matchlock, manufactured at Lahore, price £100. The relative values of the ground and ornament in these pieces are perfect; while the border of the saddlecloth is one of the happiest compositions in the collection.—113. Is a musical pipe of Eastern manufacture, and for which 5s. were paid. It is most interesting, as exhibiting, by the very rudeness of the execution of the ornament, how much of art-feeling must have existed in the humble workman who made it.—114. A basket from Singapore, price 1s. We are given to understand that this article was selected for its general grace and simplicity, and as exhibiting ornamentation arising out of the construction. The curve of the handle is certainly very elegant.—163. Vase, manufactured by Marrel, Freres, Paris, of silver and blue enamel. Price £100. Very elegant and playful in the general form, and well executed. The enamelled ornamentation is beautifully drawn. It is jewelled with garnets.—175. Iron Shield, designed by Vechte, and manufactured by Lepage Moutier of Paris. Price £220. This is remarkable for its fine style, the combination of figure and ornament, the subdued surface treatment, the variety of ornament, perfection of workmanship in every part, and as a specimen of *repousse* work.—179. Is the celebrated "La Gloire," Sevres Bisque Vase, and cost £79. 4s. It is admirable as a specimen of elegant general form; and the delicate treatment of the coloured decoration, exhibiting the limit of light and shade applicable to pictures painted on round surfaces, is very efficient.—193. A carved wood Cabinet, executed by A. Barbetti of Siena. Price £400. This is a very fine work of its style and class. Its general design, and the arrangement of its several parts, are almost faultless, while the extreme beauty and refinement displayed in the details, combined with the most perfect execution of the ornament, render it most desirable as an object of study. The subordination of the ornament to the constructive forms is especially commendable. We have space only to name a few more of these beautiful productions.—196. Oriental Agate Cup; price £210; manufactured by Morel & Co., London; enriched with pure gold, standard silver, and pearls.—200. A Silver Flagon, parcel-gilt, manufactured by Lambert and Rawlings, London; price £128. 8s. The above will roughly indicate the variety of articles at present forming the new museum. The Queen has given an example to her subjects—the fortunate possessors of works of high art—by depositing the celebrated Cellini Shield, and some rare lace, for comparison and study. Messrs. Hunt & Roskell, also, have lent a most exquisitely-designed and executed Shield and Vase by Vechte. Messrs. Morel & Co. send the large silver statue of Queen Elizabeth on Horseback, as a specimen of *repousse* work. Messrs. Lapworth furnishes specimens of Carpets; and some Silk Hangings, lent by Messrs. Jackson & Graham, of Oxford-street, are deserving of notice. The museum will be open on Mondays and Tuesdays from 10 till 4, until the 1st of November, *free to persons not students*, and on other days on payment of six-

pence each. From the 1st of November to the 1st of March, it will be open from 10 to 3.

Long's Portable Lifting Apparatus.—At a recent meeting of the Institution of Mechanical Engineers, Mr. M'Connell submitted a simple arrangement, invented by Mr. Long, the well-known hydrometer-maker, for securing an efficient lifting power in a portable and inexpensive form. In some respects it reminds us of Mr. Dick's rolling incline; but it differs from that contrivance in two essential features: its action is continuous, and its working surfaces slide

Fig. 1.

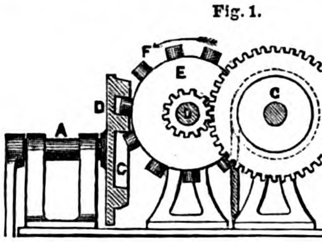
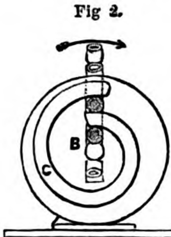
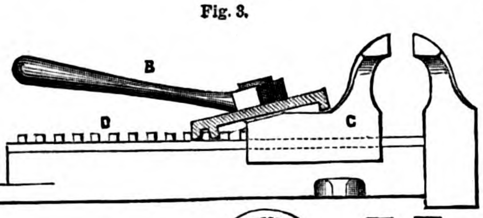


Fig 2.



or rub, instead of rolling. Fig. 1 is a side view of the apparatus arranged as a crane or hoist, and fig. 2 is a face view of the volute actuating disc. The shaft, A, is the first motion-driver, worked from a winch handle, and having fast upon it a disc, B, on the face of which is a volute or spiral projection, C. The second motion shaft, D, carries a wheel, E, with spur pins, fitted with antifriction rollers, F, and acting as teeth, their pitch being made to coincide with the pitch or eccentricity of the volute, C, with which they gear. The volute makes a little more than one turn upon its disc, so that it constantly gears with the teeth, F, and each revolution of the disc consequently moves the wheel, E, the distance of one tooth. To accommodate the volute driving surface to the angle of the teeth as they come round, it has a differential or varying bevel, so that it may bear fairly and evenly on the teeth, and the thickness of the spiral nearly fills up the space between two neighbouring teeth at all periods of revolution, preventing slip. The motion of the driven wheel, E, is conveyed to a third shaft, G, by a suitable wheel and pinion, this shaft having on it the winding drum. The inclined plane of the volute is 1 in 7; and in the arrangement which we have illustrated, the leverage of the spiral and first wheel is 11 to 1, and the spur gearing 3 to 11, giving a result of 33 to 1. Then, the radii of the winch and drum being as 6 to 1, the total gain comes to 200 to 1. In other terms, leaving out friction, a man exerting $\frac{1}{2}$ cwt. at the winch will raise 5 tons. We have said that the working surfaces are sliding ones; but in this case the rubbing action is reduced as far as may be by the substitution of rollers instead of plain teeth for the volute action, the actual rubbing being thus confined to the stud surface of the teeth. Figs. 3 and 4 exhibit a side view and plan of the apparatus, ingeniously applied as a parallel vice. Here the volute disc, A, is turned by a handle, B, so as to revolve on a stud fast in the sliding jaw, C, the traverse of the jaw being effected by the action of the spiral upon the curved teeth of the fixed rack, D. The lever being capable of unshipping, it can always be set as shown in our figure, and thus be out of the way of the mechanic who is using it. The invention is also adapted for the rack-pulleys of window blinds.

Fig. 3.



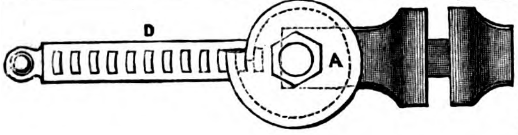
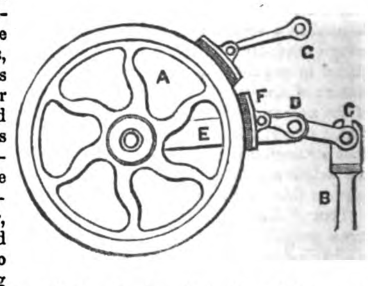


Fig. 4.

Government Trials of Anchors.—In accordance with section 3 of the Admiralty Notice, to which we some time back drew attention,* the anchors delivered to the authorities at Woolwich dockyard, for competition, have been subjected to their preliminary test. Out of about thirty exhibitors of anchors in Hyde Park, six have come forward for this searching examination. These are—Lieut. Rogers, Messrs. Brown, Lennox, & Co., Mr. Mitcheson, Mr. Honiball, Mr. Trotman, and Mr. Isaacs, an American. Mr. Isaacs' anchor has an arrangement to prevent fouling. That by Messrs. Brown & Lennox differs only slightly from Sir William Parker's plan in section and in length of shank, and in having a palm more spear-shaped. The testing with the usual strain applied to anchors of similar weight when delivered for service, commenced by placing one of Lieutenant Rogers' anchors, weighing 19 cwt. 8 lbs., in the testing-frame, and applying a strain of $19\frac{7}{8}$ tons, when the first tested arm was found to have deflected 5-16ths of an inch, and the other 5-16ths, both returning to their original position when the strain was withdrawn. On Mr. Mitcheson's anchor, weighing 21 cwt. 14 lbs., being subjected to a strain of $21\frac{5}{8}$ tons, it deflected $\frac{5}{8}$, the point of the palm extending $\frac{1}{8}$ when measured from the shank, and the other arm gave exactly the same result, the palms returning to within $\frac{1}{8}$ of their original position from the deflection, and to their entire original position when measured from the shank. Brown, Lennox, & Co.'s anchor, of 20 cwt. 3 qrs. 10 lbs., on having a strain of $21\frac{1}{2}$ tons applied, deflected $\frac{3}{8}$ and $\frac{1}{8}$ from the shank, both arms giving a similar result; and on the strain being withdrawn the deflection was entirely removed, and the arms resumed their original position. When Mr. Isaacs' anchor, of 21 cwt. 14 lbs., was placed in the testing-frame, and a strain of $21\frac{3}{8}$ tons applied, it was found to deflect $\frac{1}{4}$ of an inch, and the distance of the point of the arm 1-16th from the shank, and the other anchor gave a similar result. On the strain being withdrawn, both arms resumed their original position. Mr. Trotman's anchor, weighing 21 cwt. 1 qr., had a strain of $21\frac{3}{8}$ tons applied, and deflected $\frac{1}{8}$, the point of the arm extending 3-16ths from the shank; and on the other arm being tried, the deflection was $\frac{7}{8}$, without any extension of the arm, and on the strain being withdrawn, the deflection returned to $\frac{1}{8}$, and the arms to their original position. Mr. Honiball's anchor, weighing 20 cwt. 3 qrs. 7 lbs., had a strain of $21\frac{1}{2}$ tons applied, and the deflection was $\frac{7}{8}$, and the extension of the arm $\frac{1}{8}$, and the other arm gave exactly the same result. On the strain being withdrawn, the first tested arm returned to its original position, and the deflection of the other to within $\frac{1}{8}$, and to its entire original position when measured from the shank. Lieutenant Rodgers' kedge anchor, weighing 20 cwt. 1 qr., was placed in a testing-frame, and on a strain of $21\frac{1}{8}$ tons being applied, the deflection was 1 inch, the point of the arm extending $\frac{1}{4}$ of an inch from the shank. The deflection, when the other arm was tested, was 1 3-16th inch, and the extension of the arm $\frac{1}{4}$ of an inch, and, on the strain being withdrawn, the deflection on the one side returned to 6-16ths, and the arm to its original position. The deflection on the other side returned to $\frac{1}{4}$ of an inch, and the arm to its original position. They are now to be tried at Sheerness as regards their holding properties, and they will then return to Woolwich to determine their breaking strain. A committee of six naval officers, and the same number of eminent shipowners, assisted by Mr. Atherton, the chief engineer at Woolwich, have consented to act as jurors.

Infinitesimal Taking-up Motion for Power-Looms.—Under a recently specified patent for the improved "manufacture of textile fabrics," Mr. Harrison, the well-known machine-maker of Blackburn, has described a new "taking-up motion," which has often occurred to ourselves as a most desirable plan for the purpose. Instead of the common ratchet-wheel and catches, a small drum or pulley, having its periphery roughened by diamond lines, is used, this drum being actuated by a duplex lever and friction block, on the principle of the friction windlass movements for ships. Our figure represents the apparatus in side elevation. A is the friction pulley, to be driven by the vibration of the rod, B, in any convenient way. This rod is jointed at C, to a short double lever working on a centre at D, in the end of a longer lever, E, which oscillates freely on the stud-centre of the pulley, A. The opposite end of the lever, C, D, has jointed to it a segmental block, F, faced with leather, to work against the pulley's roughened surface. At G is a fixed centre, to which is hinged a detent lever, having a jointed friction-block like that just described. As the rod, B, rises, it is easy to see that the species of knee-joint action of the lever, C, D, will cause its friction-block to press firmly on the pulley, which is thus carried round as far as the traverse of the rod, B, permits. During this action, the detent lever, G, being set at an angle with a radial line from G to the pulley centre—the reverse of that of the lever, C, D—will allow its block to slip like the back action of an ordinary ratchet detent. As the rod, B, descends for a second stroke, its lever-block slips back, whilst that of the detent, G, holds. By the adoption of this movement, the increments of movement of the pulley, A, are not governed by any definite measure, as in the ratchet-teeth of the common wheel; and therefore, whatever minute changes are made in the traverse of the rod, B, such change will be accurately conveyed to the pulley, A. Mr. Macdowall, of Johnstone, has proposed a contrivance of a similar nature for obtaining a silent and minutely adjustable feed for the timber carriage of saw-mills. In this, as well as our own adaptation of it to power-looms, the pulley is made perfectly smooth, the friction-blocks having smooth segmental metal surfaces; for it appears to us that the elastic cushion must, to a certain extent, defeat the great point of the invention—the direct conveyance of the minute changes in the vibratory movement of the driver. Mr. Harrison effects the required variation in the driver by the increase of the diameter of the cloth beam, in a manner very similar to that adopted by Mr. Milligan.† He has also so modified the common ratchet movement, that it is capable of effecting very minute increments of take-up. He does this somewhat on the principle of the "stepped" spur-wheel, by using, say 7 catches hung on one centre, and placed parallel to each other, and increasing in length from 1 to 7 by regular gradations, the distance from the end of the first to the end of the seventh being equal to the pitch of the ratchet-wheel, which they actuate. By this means the ratchet-wheel may be moved to so slight an extent as 1-7th of a tooth, as each tooth is acted on by each individual catch in succession. Precisely the same effect is produced by using a "stepped" ratchet-wheel, that is, a wheel with several sets of teeth ar-



* Page 286, Vol. IV.

† Plate 83, p. 223, Vol. IV., P. M. Journal.

ranged obliquely, or in steps across its periphery, as in the wheel and pinion arrangements of screw steamers, one broad catch only being capable of working the whole series.

ELECTRIC TELEGRAPH IN THE BANK OF ENGLAND.—A very perfect system of telegraphic communication has just been completed, and set in operation in the Bank of England. The apparatus which has been selected is that of Mr. Dering, who, not long since, patented some valuable improvements in telegraphic machinery. By its adoption, all messages, from one point to any other given locality, are delivered in secresy—that is, they cannot be read at any other station with which the telegraphic wire communicates, so that any message transmitted from the room of the governor or deputy-governor, to the vast series of important offices under the same roof, are sent direct to their destination like a sealed letter. The growing simplification of telegraphic apparatus must now hasten its general application for domestic and private commercial purposes.

PILKINGTON'S TUBULAR KELSON FOR VESSELS.—The object of this kelson, the invention of Mr. Pilkington of Goole, near Leeds, is to give a greater degree of strength and durability than can possibly be obtained in oak or other timber kelsons hitherto used, without causing any additional dead weight in the ship; as well as the obviation of the great difficulty experienced by shipbuilders in obtaining suitable lengths and sizes of timber, as required by "Lloyd's" regulations for

Fig. 1. Fig. 2.

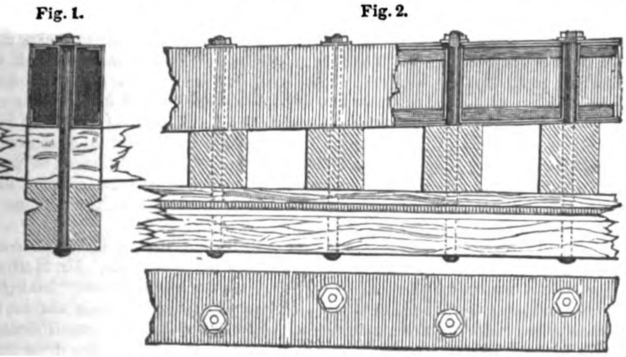


Fig. 3.

first-class vessels. Being tubular and perfectly water-tight, this kelson may also be used as a water-tank, or for ballasting the ship when without cargo, the water being introduced through a cock communicating with the outside of the vessel, and placed in any convenient part; another cock allows the water to be let out into the bottom of the vessel, whence it may be pumped up by the ship's pumps. Fig. 1 of the engravings represents the kelson in transverse section; fig. 2 is a side elevation, partially sectioned longitudinally; and fig. 3 is a plan. The tubular space thus obtained may also be turned to use as a water-tank, relieving the vessel from the weight and inconvenience of the stowage of a quantity of casks. The advantages of this simple plan are obvious.

THE "ERICCSON" CALORIC SHIP.—Captain Ericcson, the indefatigable screw-propeller, file-machine, and heated-air engine-improver, is still occupied in mechanical pursuits; and we now hear of him in Boston, U.S., as again busying himself with heated air as a motive power. For the last eight months he has had working in that city a "caloric engine" of 60 horse power, having two pairs of 72-inch cylinders. English engineers will think this proportion of machinery to the resultant power to be somewhat in excess; but it is argued, that by using large areas of piston, he is enabled to work at a very low air-pressure, and, consequently, a less injurious excess of heat, than has been necessary in all the earlier air-engines. Provision is said to be made for the husbanding of the heat to the utmost limit, by continuous retransfers of the caloric as it is expended in producing the alternate dilatation and condensation of the air; hence a great economy is promised. A ship of 2,200 tons, to be called the "Ericcson," is now far advanced in building, for a trial of this new power at sea. She is to have four cylinders, of the unheard-of diameter of 168 inches each, and will be propelled by paddles. She is promised for sea by October, when we may, perhaps, make her acquaintance.

THE GREAT BRITAIN AFLOAT.—The event which we some time ago announced† is now a veritable fact. The "Great Britain," after the removal of her old lumbering engines and screw-gear, and receiving a complete overhaul, left the Mersey for New York, on her first voyage, on the 1st of May, and accomplished the distance in 13 days 5½ hours. On the twelfth day she performed what has never been reached by screw steamers before—in running 301 miles in twenty-four hours. She met with bad weather throughout the whole run, the use of canvas being almost wholly out of the question.

GREAT BRITAIN'S MERCANTILE MARINE.—The vast extent of our shipping trade, and the enormous fleet for which it finds employment, may be gathered from the official statement of a single month's work. During the month ending the 5th of April, there were 1,920 sailing vessels of 319,242 tonnage, and 308 steam vessels of 87,542 tonnage, employed in the trade of the United Kingdom, entered inwards; and 2,243 sailing vessels of 475,294 tonnage, and 314 steam vessels of 87,463 tonnage, cleared outwards, in the same period.—The story of the coasting trade is equally well told, in the relation of the fact, that 1,235 steam vessels of 288,952 tonnage, and 10,567 sailing vessels of 791,385 tonnage, entered inwards, and 1,246 steam vessels of 284,709 tonnage, and 12,009 sailing vessels of 897,183 tonnage, cleared outwards in the same month.

PATENT PRACTICE.—A very important case has been decided during the last month with respect to the effect of the new practice, as to the deposit particulars required on applying for English patents. Messrs. Laming and Evans obtained letters patent on the 23d April, 1850, for "Improvements in the manufacture of gas for illumination," &c., and on petitioning for the patent, deposited in the Attorney-General's Office the usual particulars, comprised under seventeen heads. When the patentees came to specify, instead of confining themselves to the inventions described in their particulars, they specified only eight of their seventeen heads, and introduced and claimed ten entirelynew and distinct matters. Messrs. Laming and Evans, finding some time after that their patent was to be attacked on this ground, applied to the Attorney-General for leave to disclaim the new heads of invention, but their application was very properly refused, on the ground that a fraud had been committed on the crown. By means of this decision, Messrs. Laming and Evans were left entirely without defence to an action of *scire facias*, and the patent has consequently been repealed. This will, we hope, act as a warning to patentees, that they must be content with their invention being secured to them at the time of the patent, as, by grasping at more, they will inevitably lose the whole.

THE SILESIAN INDUSTRIAL EXHIBITION.—Close upon our comment on the destination of our own Crystal Palace last month, we are called on to notice the appearance of its earliest continental copy. Breslau, remote as it is in the German provinces, has been the first to take advantage of the schooling which it received in Hyde Park, and within a year from the grand opening there, has Silesian industry formed a stage of exhibition in its own clime. In name only does the building resemble its great original. It has a lengthy nave and a transept, with a mimic fountain at their intersection, with side aisles and galleries. But the materials of erection are of the every-day class: the beams are timber, and the roofing slate. We have no exact dimensions before us, but we are told that twenty-nine such buildings would have stood under the roof of that in Hyde Park. Its stores are the best in the iron, linen, and woollen divisions, the staples of the province. Carriages are by no means bad, and some display is made of machines in motion. Two colossal figures of a German and Spanish halberdier, in hammered zinc, are justly regarded as important acquisitions, for their attitudes are natural, and the details of costume admirably copied. Photography is pretty well represented, but art on the whole musters sparingly. The admission for the first fortnight is 1s. 6d., and it is then to be considerably reduced. When it is in better show order, we may be able to pronounce our verdict upon it.

ORDNANCE RANGE AND VELOCITY.—The longest range and greatest velocity ever accomplished by any ordnance, ancient or modern, up to the period of 1840, and we believe to the present time, is 5,720 yards, or just three miles and a quarter. The whole time of flight was only thirty seconds and a quarter, which is estimated at 2,100 feet in the first second of time. The piece of ordnance used on this occasion was a fifty-six-pounder cannon, cast on the principles of Mr. Monk, who suggested the propriety of removing a considerable proportion of useless metal from the gun before the trunnions, and adding it to the breech, where alone increased strength is desirable. This arrangement permits the use of a larger projecting charge of gunpowder, without risking the calamity of bursting. The quantity of powder employed in the experiment alluded to was ten pounds, and *the ball weighed sixty-two pounds and a half*, a circumstance which requires some explanation, seeing that we have stated the gun to be a fifty-six-pounder. The explanation is this: the momentum of a projectile is the product of its mass and its velocity; by increasing that mass, therefore, or, in other words, by adding to its weight without adding to its size, we acquire a proportionate increase of momentum, and a consequent increase of range. The shot on the present occasion was an iron shell filled with lead; hence its weight of sixty-two pounds and a half. Nearly the same range was accomplished by the French during the Peninsular war, who threw shells into Cadiz, rather more than a distance of three miles; they, however, used enormous mortars, one of which is at present in St. James's Park, and employed the largest charges of gunpowder ever known in modern times; the missiles projected, moreover, were shells *nearly* filled with lead, the remaining space containing gunpowder, ignitible by a fuse, as in the common shell. The fact that leaden balls accomplish a longer range than iron ones, seems to have been discovered at least *once* by chance, the discoverers being totally ignorant of the principles on which the circumstance was founded. It is related that, during the war, an American ship having expended all her cannon-balls, and being unable to procure others of a similar kind, had some prepared of lead; when, on employing them in a subsequent action, her captain and crew were surprised at their long range and efficacy. Sir Howard Douglas is so satisfied of their advantages on peculiar occasions, that he recommends their introduction in the navy.

ENGLISH PATENTS.

Sealed from 22d May, to 19th June, 1852.

William Watt, Glasgow, Lanark, North Britain, manufacturing chemist,—"Improvements in the treatment and preparation of flax or other fibrous substances, and the application of some of the products to certain purposes."—22d May.

David Dick, Paisley, Renfrew, North Britain, machine-maker,—"Improvements in the manufacture and treatment or finishing of textile fabrics and materials."—22d.

Richard Roberts, Manchester, engineer,—"Certain improvements in and applicable to boats, ships, and other vessels."—22d.

John Harcourt Brown, Aberdeen, Scotland, and John Macintosh, of the same place,—"Improvements in the manufacture of paper and articles of paper."—22d.

Louis Victor Ruze, Gaillon, France, manufacturer,—"Certain improvements in the manufacture of hat-plush and other similar silk cloths."—22d.

John James Russell, Wednesbury, Stafford, patent tube manufacturer,—"Improvements in coating metal tubes."—22d.

* Page 167, Vol. IV.

Edward Thomas Bainbridge, St. Paul's-churchyard,—"Improvements in obtaining power when fluids are used."—22d.

Samuel Cunliffe Lister, Manningham, near Bradford, York, machine woolcomber,—"Improvements in treating and preparing, before being spun, wool, cotton, and other fibrous materials."—22d.

John Swarbrick, Blackburn, Lancaster, firebrick manufacturer,—"Certain improvements in the method of manufacturing retorts used for gas and other purposes, and in the apparatus connected therewith."—22d.

Alfred Vincent Newton, Chancery-lane, Middlesex, mechanical draughtsman,—"Certain improvements in winnowing machines."—(A communication.)—22d.

Thomas Knott Parker, London-wall, Middlesex, carpenter,—"Improvements in window sashes."—22d.

Johann Stierba, of the firm of Messrs. Eisbrick & Co., Prague, Bohemia, gentleman,—"Improvements in furnaces, and in heating and utilising certain products of combustion."—22d.

John Mason, Rochdale, Lancaster, machine-maker, and George Collier, Halifax, York, manager,—"Certain improvements in preparing, spinning, twisting, doubling, and weaving cotton, wool, and other fibrous materials; also in tools or apparatus for constructing parts of machinery used in such manufactures."—22d.

Joseph Walker, jun., Wolverhampton, Stafford, merchant,—"Certain improvements in vacuum pans for the evaporation and crystallisation of saccharine or other solutions."—(A communication.)—25th.

Henry Webster, Manthorpe, Lincoln, wheelwright,—"Improvements in regulating the draught in chimneys or flues."—25th.

Adolphus Charles Von Herz, Cecil-street, Middlesex, esquire,—"Improvements in treating, preparing, and preserving roots and plants, in extracting saccharine and other juices from roots and plants, in the treatment of such juices, and in the processes, machinery, and apparatus employed therein."—29th.

Frederick Miller, Fenchurch-street, London, gentleman,—"Improvements in apparatus for hatching eggs."—29th.

Joseph Lees, the younger, Manchester, calico-printer,—"An improved system of preparing, cutting, and engraving rollers to be used for printing woven and other fabrics, and improved machinery for printing and washing the same fabrics."—29th.

Alexander Bain, Beevor Lodge, Hammersmith, gentleman,—"Improvements in electric telegraphs and in electric clocks and time-keepers, and in apparatus connected therewith."—29th.

William Septimus Losh, Wreay Sykes, near Carlisle, gentleman,—"Improvements in the purification of coal gas."—29th.

Richard Ford Sturges, Birmingham, manufacturer,—"Certain new or improved ornamental fabrics."—29th.

William Armand Gilbee, South-street, Finsbury, Middlesex,—"Certain improvements in machinery for cutting corks."—1st June.

Alfred Vincent Newton, Chancery-lane, Middlesex, mechanical draughtsman,—"Improvements in machinery for propelling vessels, and in apparatus to be used in connection therewith."—(A communication.)—1st.

William Henry Phillips, Camberwell, New-road, Surrey, engineer,—"Improvements in decorative illumination, and in applying light for other purposes."—1st.

Thomas Willis, Manchester, machine-maker,—"Certain improvements in machinery or apparatus for winding yarns or threads, and also improvements in looms for weaving."—1st.

Samuel Morris, Stockport,—"Certain improvements in steam-boilers."—3d.

William Haughton, Manchester,—"Improvements in machinery for spinning cotton and other fibrous substances."—5th.

Robert Hardman, Bolton,—"Improvements in looms for weaving."—5th.

Laurent Machabee, Avignon,—"An improved composition applicable to the coating of wood, metals, and other substances to be preserved from decay."—8th.

Edme Augustin Chameroy, Paris, manufacturer,—"Certain improvements in steam-engines."—8th.

Enoch Townend, Keighley,—"Certain improvements in the manufacture of textile fabrics."—8th.

William Gratrix, Salford,—"Certain improvements in the production of designs upon cotton and other fabrics."—8th.

William Rettie, Aberdeen,—"Certain improvements in lamps and burners, in apparatus for ventilating apartments, and in the mode of working signal-lamps."—8th.

Henry Houldsworth, Manchester,—"Improvements in embroidering-machines, and in apparatus used in connection therewith."—10th.

Thomas Wilks Lord, Leeds,—"Improvements in machinery for spinning, preparing, and heckling of flax, tow, hemp, cotton, and other fibrous substances, and for the lubrication of the same and other machinery."—10th.

William Beasley, Kingswinford,—"Certain improvements in the manufacture of metal tubes and solid forms, and in apparatus and machinery to be employed therein."—10th.

Michael Joseph John Donlan, Rugely, Staffordshire,—"Improvements in treating the seeds of flax and hemp, and also in the treatment and preparation of flax and hemp for dressing."—10th.

Edwyn John Jeffery Dixon, Royal Slate Quarries, Bangor, and Arthur John Dodson, of the city of Bangor, gentleman,—"Improvements in machinery and apparatus used in quarrying slate and stone; and in cutting, dressing, planing, framing, and otherwise working and treating slate and stone; and in apparatus and waggons used for removing and conveying slate and stone; and improvements in joining, framing, and connecting slate and stone."—12th.

William Reid, University-street, electric telegraph engineer, and Thomas Watkins Benjamin Brett, Hanover-square, gentleman,—"Improvements in electric telegraphs."—12th.

Jean Ernest Beauvalet, Paris, gentleman,—"Improvements in the manufacture of iron and steel."—(Communication.)—12th.

Joseph Brandeis, Great Tower-street, Middlesex,—"Improvements in the manufacture of raw and refined sugar."—12th.

George Pate Cooper, Suffolk street, Pall-mall East, tailor,—"Certain improvements in fastenings for garments."—12th.

Thomas Restell, Kennington, Surrey, watch manufacturer,—"Certain improvements in the construction of lamps and burners."—17th.

James Norton, Ludgate-hill, merchant,—"Improvements in apparatus for ascertaining and registering the mileage run by public vehicles during a given period; also the number of persons who have entered in or upon, or are travelling in public vehicles; part of which improvements is applicable to public buildings and other places where tolls are taken."—17th.

SCOTCH PATENTS.

Sealed from 22d May, to 22d June, 1852.

John Harcourt Brown, Aberdeen, Scotland, and John Macintosh, of the same place,—"Improvements in the manufacture of paper, and articles of paper."—24th May.

Charles James Pownall, Addison-road, Middlesex, gentleman,—"Improvements in the preparation and treatment of flax, and other fibrous and vegetable substances."—28th.

John Weems, Johnstone, Renfrew, North Britain, tinsmith,—"Improvements in the manufacture or production of metallic pipes and sheets."—31st.

Alexander Johnston Warden, Dundee, Forfar, Scotland, manufacturer,—"Improvements in the manufacture of certain descriptions of carpets."—31st.

Joseph Swan, Glasgow, Lanark, North Britain, engraver,—"Improvements in the production of figured surfaces, and in printing, and in the machinery or apparatus used therein."—10th June.

George Searby, Chelsea, Middlesex, decorator,—"Certain improvements in apparatus for cutting and carving metal, stone, and other substances."—(A communication from abroad.)—11th.

John Frearson, Birmingham,—"Improvements in cutting, shaping, and pressing metal, and other materials."—14th.

Thomas Twells, Nottingham, manufacturer,—"Certain improvements in the manufacture of looped fabrics."—14th.

Andrew Fulton, Glasgow, Lanark, North Britain, hatter,—"Improvements in hats, and other coverings for the head."—14th.

William Eward Newton, Office for Patents, 66 Chancery-lane, Middlesex, civil engineer,—"Improvements in machinery for weaving, colouring, and marking fabrics."—(A communication from abroad.)—15th.

James Edward Coleman, Porchester House, Bayswater, Middlesex, gentleman,—"Improvements in materials and apparatus to be employed in parts of railways, of engines, and of carriages, and in the application of such materials to those purposes, and to the manufacture of textile and other mechanism."—(A communication from abroad.)—16th.

William Hindman, Manchester, Lancaster, gentleman, and John Warhurst, Newton Heath, near Manchester, cotton dealer,—"Certain improvements in the method of generating or producing steam, and in the machinery or apparatus connected therewith."—16th.

Richard Archibald Brooman, of the firm of H. Robertson & Co., 166 Fleet-street, London, patent agents,—"A reaping machine."—(A communication from abroad.)—17th.

William Gratrix, Salford, Lancaster, dyer and printer,—"Certain improvements in the production of designs upon cotton and other fabrics."—17th.

James Edward M'Connell, Wolverton, Bucks, civil engineer,—"Improvements in steam-engines, in boilers, and other vessels for containing fluids, in railways, and in materials and apparatus employed therein or connected therewith."—18th.

DESIGNS FOR ARTICLES OF UTILITY.

Registered from 21st May, to 19th June, 1852.

May 21st,	3262	J. Wanthier, Willmington-square,—"Portable and house barometer."
—	3263	W. C. Cambridge, Bristol,—"Straw-shaker."
22d,	3264	R. Mallet, Dublin,—"Iron plate for roofs."
—	3265	C. Lenny, Croydon,—"Carriage-wheel plate."
24th,	3266	A. J. Schatt, St. James's,—"Royal Cambridge valve bugle."
25th,	3267	R. W. Winfield, Birmingham,—"Spring letter-balance."
26th,	3268	W. Quinton & Co., Birmingham,—"Rule joint."
—	3269	W. Dray & Co., London-bridge,—"Cradle machine for washing and gold detecting."
—	3270	G. Harriott, North Walsham,—"Screw clod-crusher."
27th,	3271	C. Richards, Birmingham,—"Core peg for Minié rifle-bullet moulds."
28th,	3272	W. Wellby, Bermondsey,—"Life-buoy."
—	3273	T. F. Griffiths, Birmingham,—"Letter-box."
—	3274	J. Tuke, Doncaster,—"Water-closet."
June 1st,	3275	Henry Maling, Home-office,—"Form of rifling for fire-arms."
—	3276	L. Stubbs and T. Fleming, Birmingham,—"Nail or screw."
—	3277	Robert Adams, King William-street,—"Balls or projectiles."
2d,	3278	F. Brampton, Birmingham,—"Music folio or leaf-holder."
—	3279	Wagstaff & Co., Mark-lane,—"Portable candle-lamp."
3d,	3280	T. A. Readwin, Winchester-buildings,—"Self-acting currycomb."
—	3281	E. Windsor, Lille, France,—"Gill machinery."
4th,	3282	P. Lawson & Son, Edinburgh,—"Box-edging cutter."
—	3283	J. J. Ball, Wenlock-road, City-road, Master R.N.,—"Disengaging apparatus for lowering boats from ships' sides at sea."
5th,	3284	J. Barnett, Birmingham,—"Apparatus for heating water."
—	3285	T. Bland, Birmingham,—"Cover for vessels."
—	3286	W. Smith, Bucks,—"Subsoil plough and stirrer."
7th,	3287	W. Dray & Co., Swan-lane, Upper Thames-street,—"Chaff and litter-cutting machine combined."
—	3288	J. Tucker, Charlton, Kent, and J. E. Saunders, Gracechurch-street,—"Inflated water-proof tent."
—	3289	W. Bridson, Liverpool,—"Plate and dish warmer and meat cooler."
8th,	3290	T. F. Griffiths, Birmingham,—"Gold-washing and detecting machine."
9th,	3291	J. J. Ball, Wenlock-road, City-road,—"Disengaging apparatus for lowering boats."
10th,	3292	J. Cooper, Towerhead, near Somerset,—"Compound geometric and spiral chuck for a lathe."
—	3293	E. Bull, Halifax,—"High-pressure valve or stop-cock, for gas, water, or other fluids."

DESIGNS FOR ARTICLES OF UTILITY.

Provisionally Registered, from 20th May, to 5th June, 1852.

May 21st,	321	F. P. Rovere, New-inn,—"Mars bullet-mould."
29th,	322	M. P. P. Brouillet, Finsbury,—"Self-adjusting candle-shade."
—	323	J. A. Donaldson, Poland-street,—"Fan-shaped window-blind.

TO READERS AND CORRESPONDENTS.

E. B., U.S.—His communication, marked "paid," cost us 2s. How is this?

R. S., Preston.—If he will look over the monthly lists of scientific books, given in our "Mechanic's Library," he will find the titles, prices, and authors' names of all the modern works of this class. The processes are constantly changing, from the effects of daily discoveries. The latest is usually the best.

RECEIVED.—"The Hydraulic Motion Regulator."—"Projectile Weapons of War," &c. by John Scoffern.—"Elements of Practical Geometry."

H. C., Bath.—We wrote per post. Is the information satisfactory?

A. F.—See "Weale's Rudimentary Treatises," also "Bourne on the Screw."

C. L.—We shall have pleasure in referring to the subject on which he writes, in our next number.

G. R.—The drawings are, we believe, accurate representations of the engines. There is no practical objection to the use of a single air-pump only, on the ground he mentions. There is a great deal in the arrangement of the details of the condenser and fluid jets, as affects the working of the pump; and although the pump does look small, it performs its task well, as most Clyde-going people are aware. We fear his friends have misconceived the air-pump action as affected by any given position of its actuating crank, in relation to that of the crank of the steam-cylinder If he will detail this to us more fully, we shall be glad to explain any obscurity.

IMPROVEMENTS IN

STEAM MACHINERY.

J. E. M^c CONNELL, ENGINEER, WOLVERTON.

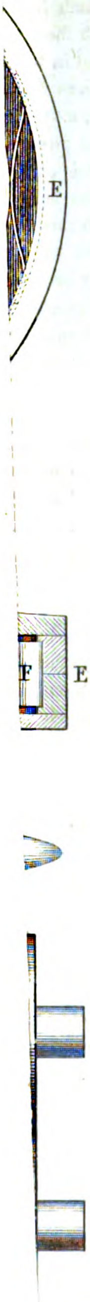
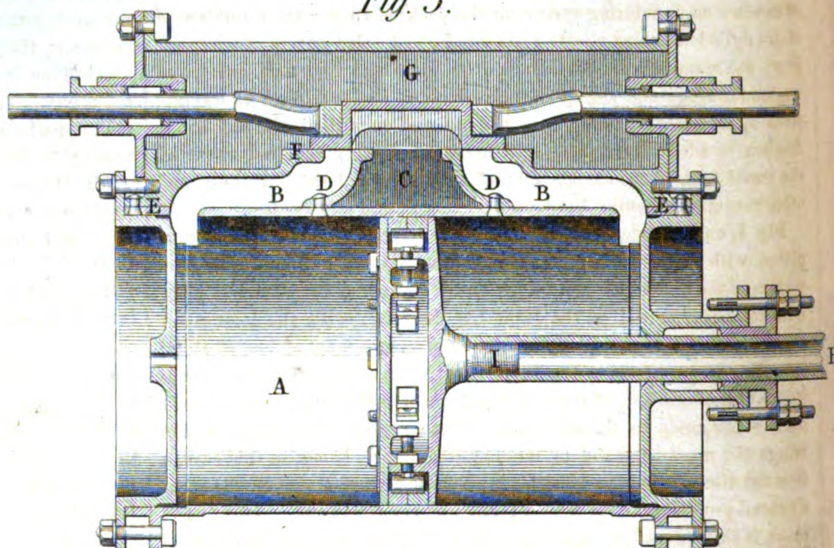
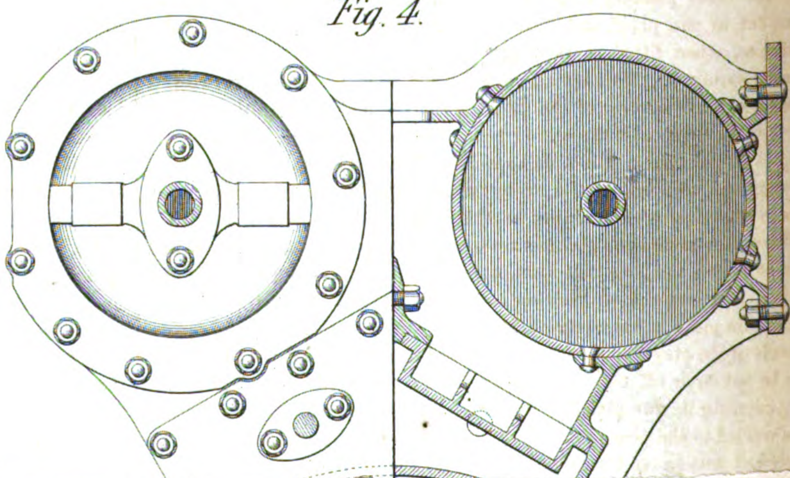


Fig. 3.



1/12th

Fig. 4.



M'CONNELL'S IMPROVEMENTS IN STEAM MACHINERY AND RAILWAY AXLES.

(*Illustrated by Plate* 103.)

In these improvements, the invention of Mr. J. E. M'Connell, the well-known superintendent of the locomotive department on the huge London and North-Western line, are introduced the several essential novelties of moulding pistons and covers in wrought-iron, with the screwing on of the cover in the manner of a box-lid, and an arrangement of continuous undulating spring for the packing rings; the formation of steam cylinders, valve chests, and cylinder and valve covers of wrought-iron; the manufacture of tubular piston and connecting rods, axles, and engine framing; the supply of diffused air to the fire-boxes of locomotives by means of tubular stays; the indentation of the boiler and inside fire-box to admit the driving axle beneath; heating the feed-water by the waste heat of the smoke-box and blast-pipe, and the "steeling" and otherwise strengthening the journals of crank and other axles.

Fig. 1, on our plate 103, is a plan of a wrought-iron locomotive engine piston, with the cover or loose plate removed. Fig. 2 is a transverse section of the piston, showing a portion of its rod, as forged in one piece with the body, as well as the lever handle for screwing the loose cover on and off. These pistons are made by placing a mass of heated metal beneath a steam-hammer, the anvil of which is of a section corresponding to that of one side of the piston body, whilst the face of the hammer itself corresponds to the other side. The swaging or moulding action brings the mass of metal to the required figure, being, in this case, a thin flat disc, having on one side a projecting ring, A, and on the other a central projection, B, to form a portion of the piston-rod. This forged blank is then turned up and finished in the lathe, an internal screw of coarse pitch being cut on the ring, A, for receiving the plate, C, which has a corresponding ring, D, similarly forged upon it.

The brass packing rings, E, are of uniform section throughout, and are cut in one place, and made to bear outwards against the cylinder surface, when fitted in their places, by a continuous undulating flat metal spring, F. This spring encircles the ring, A, abutting between it and the inner surface of the packing rings, which are slightly grooved to receive them, and the spring being narrower than the depth of the space in the piston, it is thus kept free of side friction. The spring is set up and adjusted by the set screws, G, tapped through the ring, A, so as to bear against the spring at the apex of each internal projection. When the springs and packing are in their places, the plate, C, is screwed on at D, and the two stay bolts, H, are then passed through holes in the plate, and screwed at their opposite ends into the body of the piston. The thin plate, I, has square holes cut in it for entering upon the square heads of the stays, to prevent them from turning. When the plate, C, is to be put on or off, the double-handed lever, J, is used for unscrewing it, by entering its two pins into the stay holes. The piston-rod may either be welded to the piece, B, on the body of the piston, or the latter may be screwed to receive the tapped end of a tubular rod, as shown in fig. 3. This figure also illustrates another modification of this form of piston. In it, the projecting piston ring is forged entirely on the body of the piston, the cap being merely a flat disc, held in position by a ring of set screws. The inner surface of the ring is cylindrical, but, externally, it is polygonal. The wide portions of the ring, at the apices of the inclines on the polygonal surfaces, afford room for the reception of the set screws, and the spaces between each pair of adjoining apices are appropriated for holding the detached semi-elliptical, or bow-shaped blade-springs for the packing.

The locomotive engine cylinder in which this piston is fitted, with its covers, stuffing-boxes, steam-chest, and passages, is formed entirely of wrought-iron. The cylinder, A, is formed out of a flat plate of metal, turned up, scarfed, and welded at the junction, and bored out in the usual manner; and the portion in which the steam and exhaust passages, B C, and the valve face, are contained, is forged in two separate pieces—the exhaust port, C, being riveted to the cylinder at D, whilst the remaining portion, which is combined to form the steam passages, is riveted at E—the valve face, F, being planed out of both pieces. The valve chest, G, is formed in the same way as the cylinder, and it is bolted to the flanges of the piece forming the steam passages. The whole of the parts, or nearly so, may be forged, or moulded by dies or matrices, in the same way as the pistons. The piston-rod, H, is tubular, and is screwed on to the piston at I. Fig. 4 is an end elevation of the pair of cylinders combined, one being in transverse section. They are connected together by intermediate brackets above and below, bolted and riveted at the junctions; and externally they are bolted to the wrought-iron engine framing, by brackets riveted to the cylinders, and bolted to the frame. This system of construction, abounding so much in light hollow parts, saves a large amount of weight, in comparison with the usual plan, besides producing work of much greater soundness.

Mr. M'Connell illustrates his extended use of tubular forms in various constructive details, such as piston-rods, connecting and eccentric-rods, axles, and engine framing, the tubular lengths being either screwed to their solid connections, or welded.

The combustion of fuel and gases in ordinarily constructed fire-boxes, is well known to be feeble and inefficient, permitting the wasteful escape of a large quantity of the evolved gases, owing to the want of a due supply of air to mix with them. Mr. M'Connell affords an additional supply by means of a series of tubular fire-box stays, interspersed at the front end of the fire-box amongst the solid stays, and acting with the latter, in holding together the inner and outer fire-boxes, into which they are screwed at each end in the usual way. The position of these tubular stays or air-channels, on the side directly opposed to the atmosphere during the engine's motion, causes a strong rush of air in a diffused state amongst the incandescent fuel, and small valves being attached to each passage, the engine-driver has the means of admitting exactly what is required. Instead of confining the inside fire-box, horizontally, to the limits of the vertical line of the outside box, where it joins the barrel of the boiler, Mr. M'Connell carries forward the upper portion of it into the barrel—this extension, together with the under side of the barrel, being indented to allow the driving axle connections to work clear beneath it. The extended portion of the inside box terminates in the usual way, in a tube plate, so that, whilst a very large effective heating area of fire-box is secured, the existing objectionable length of the flue tubes is greatly reduced. The heating of the feed-water, prior to its supply to the boiler, is economically effected, by employing the waste steam from the cylinders for this purpose, in conjunction with the heat of the waste gases, as they pass off from the furnace to the chimney. The blast-pipe is wholly encircled by a water-space jacket, outside which is a double coil of piping. The cold water from the tender is first conducted into the external coils of pipes, and it is thus subjected to the smoke-box heat. It then passes along the annular jacket of the blast-pipe, and is consequently further heated by the escaping steam, when it flows off at the bottom to the boiler.

In Mr. York's tubular railway axles, which attracted a good deal of attention some ten years ago, the great practical defect of want of uniformity in the structure of the metal has always been very prejudicially manifested, and accidental fractures have been extremely frequent. Mr. M'Connell's system of manufacturing these, however, now obviates this difficulty, and restores the hollow axle to the position which Mr. York originally intended it to occupy—by insuring uniform density of the metal throughout. For this purpose, the iron is first rolled out into a long narrow plate of the desired breadth and thickness, the two long parallel edges being beveled off, so that, when the plate is turned up to form a tube, the bevels will form a scarf joint. When bent into the tubular form, it is welded by passing between rollers, and the axle is finally shaped by rolling between two massive shaping plates.

Fig. 5 is a side view of a pair of rolls as contrived for rolling two dif-

ferent widths of plates with beveled edges; fig. 6 is a transverse section of such a plate as removed from the rolls; and fig. 7 is a transverse section of a plate bent round to the tubular form, in readiness for welding the longitudinal joint. Fig. 8 is a vertical section of the pair of shaping plates, as having just finished an axle. The rolled plates are bent into tubes, just as in the ordinary process of making wrought-iron lap-welded tubes. They are then heated to the welding point, and the junction is effected by passing them through a pair of rolls of cylindrical section, whence, at the same heat, they are conveyed to the shaping plates, A B, fig. 8. These plates are heavy masses of metal, having their shaping surfaces formed to correspond to the longitudinal contour of the intended axle, so that, when placed together, or near each other, they enclose a space, the vertical section of which is of the same form as the longitudinal section of the intended axle. The upper shaper, A, is the moveable or traversing one, B being the fixed base; and the plain tube being laid between the two, it is quickly rolled into the axle shape, C, by the reciprocatory traverse of the upper shaper, as it rests on the tube. Any shape may thus be given to the axle, as in the example selected in fig. 8, where the journals—the enlarged portions for carrying the wheels, and the central taper—are all formed at once. This gradual shaping process is one of pure squeezing, completely doing away with the defects arising from swaging and hammering, and all the sudden percussive shocks of the usual system of manufacture, and the axles have a perfect lap weld, and are obviously of a uniform thickness of metal.

Mr. M'Connell also proposes to strengthen straight tubular axles, as at the portions where the wheels are keyed on, by drawing on to the axles short pieces of tube, and then welding them fast in one mass with the axle surface. Again, in "steeling" solid iron axles, a steel tube of the required length is drawn upon the axle, and welded in a similar manner, so as to secure greater strength and stiffness than is obtainable in the ordinary iron axle. In steeling the journals or bearing surfaces of crank axles, these portions are first turned, or slotted down to the required size, and the steel is then lapped round the parts in a thin sheet, the two metals being welded together in clean fires, using freely a flux of borax and pounded silica.

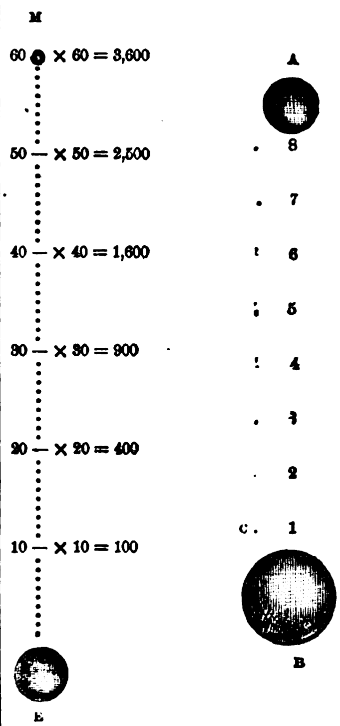
SCIENCE.

II.

The mode of generalizing which we attempted to describe in our last paper, is called "Induction," being that method of interpreting nature, which the illustrious Bacon recalled, by his writings, to the due attention of mankind. It consists, as his distinguished successor on the woolsack, Lord Brougham, has concisely pointed out, "in only admitting those things which the facts prove to be true, and excludes the supposing things, merely because they square with the facts."* The leading principle, therefore, of recent science, is to ascertain the universality of a fact; and not, as did the pseudo-philosophers of old, and the schoolmen-naturalists of the middle ages, first, from a mere few apparently agreeing facts, to imagine a general or universal law, and then to twist and torment, as it were, all other natural appearances into a false conformity with the preconceived and false conclusion. It was this obscure method of proceeding, which was the great impediment to progress. But it was easy to the teacher and the learner—gratifying to the vanity of the one, and agreeable to the indolence of the other; and thus was the system thrust on the public mind, young and old, in the schools and out of the schools, founded upon the mere authoritative *ipse dixit* of some man, a little distinguished above others in the learning of the times, or by station, or family connection.

We have already referred to the law of gravitation, as having been promulgated by Newton. Perhaps it may assist our after remarks, if we attempt to give some general idea of what this means. Every one knows the effect of a falling body—a piece of lead or wood. Drop it; you may hold your hand perfectly still, and give the thing no impulse, in other words, exert no power to compel it to move in a direction downwards. Now, from what cause does it fall? Some might answer, "From its own weight." "It falls of itself." But what magic is there in the word "weight?" or has the thing a principle of motion in itself, which, immediately you let go your hold, it exerts and precipitates itself on the ground? No; it falls by reason of its attraction by the earth—the attraction of gravitation. The law regulating the descent of every such kind of body was shown by Newton to extend between the moon and the earth—between the satellites of other planets and the planets around which they revolve, and between every planet then known and the sun. Hence, to it, as the most universal physical truth which has yet been attained, we are to look as a fundamental cause of all the magnificence and beauty with which we are surrounded—the recurrence of the seasons, and of the whole kaleidoscopic pageantry of nature. For, if this law of gravitation did not exist, we should have no sunshine, no seed-time, no harvest; the faces of the earth and sky would be decked with no colours; all would be a universal black blank, without light, beauty, warmth, or human life, except as our globe, in its devious and unrestricted plunge through illimitable space, might now and then, in passing the radiant orbs of the starry suns, have exposed upon its surface, to the observation of some beings, but certainly not of man, its frozen and undecorated form.

By gravitation is thus meant that law, the formal expression of which is, that *all particles of matter attract one another directly as their masses, and inversely as the squares of their distances.* This may be better understood by a diagram.



Suppose E to represent the earth, and M the moon (and the sizes and distances here given, will afford some idea of the true relative sizes and distance of these two bodies); now, the one is said to attract the other directly as its mass. If, therefore, the earth were double the mass it is, it would attract the moon with double the force it does; if treble the mass, then with treble the force, and so on; and the same with the moon. Again, suppose that A and B represent two bodies, B being eight times the mass of A, they would meet in space at the point C. Why? Because B would attract A with eight times the force with which A would attract B. Hence, while A was rapidly moving to the point C, B would be slowly moving to the same point. It is unnecessary to tell our mathematical readers that these diagrams are not strictly correct, but they are sufficiently so for the general purpose. But the law also says, that the particles of matter attract one another inversely as the squares of their distances. What is meant by this? The mean distance of the moon from the earth (capable of being readily and accurately found by astronomers) is 60 semidiameters of the earth. The square of the distance, therefore, of the moon from the earth is 60 times 60, or 3,600; and as the particles of matter attract one another inversely as the squares of their distances, a body on the surface of the earth would be attracted by the earth, or, in other words, gravitate to the earth, with a force 3,600 times greater than the same body would gravitate to, or be attracted by, our planet, at the distance of the moon. Or, in another way of putting the example, a body at the distance of the moon would gravitate to the earth with $\frac{1}{3600}$ part of the force with which it would gravitate to the earth, if placed upon its surface. To state the fact still more simply, a body weighing 3,600 lbs. at the surface of the earth, would weigh 1 lb. only, if it could be weighed at the distance of the moon. The distance, and square of the distance, otherwise marked upon this diagram, show the force of gravity at the relative intermediate distances. All this has been, by ingeniously constructed instruments, physically demonstrated.

From what we know at present, the whole architecture of the heavens and the earth, atom upon atom, and sun upon sun, seems to be erected under the authority of this fundamental law; and strange as the fact may appear, each hair of our head is thus influenced by, and influences the most distant star. This law it is which has given celebrity to what is called the Newtonian philosophy, first promulgated in a work commonly called the 'Principia,' and a copy of which, in the handwriting of

* Discourse of Natural Theology, p. 165.

Newton, is now justly cherished as the most valuable relic in the library of the Royal Society of England, at Somerset House.

All these facts and expressions are very simple; and ascending, as we may, to the very apex of human thought, we shall still find that all we may know is also as simple. The base, indeed, necessarily becomes comparatively wider; but there is no difference found, as regards simplicity, in the steps by which we ascend to the highest demonstrations. It is thus seen, that science is not that grim and terrible thing that inconsiderate people are in the habit of mistaking it to be, and, therefore, to be approached only with fear and trembling; or as if the words "Touch me not," were written upon her shrine. No; they who are willing to esteem themselves the most ignorant, are the most welcome to her; and to proper humility nature readily unveils, as well her known truths, as her secrets. The philosopher—a name, by-the-by, much abused, for it has always meant nothing more than a lover of wisdom—a lover of truth—the most learned philosopher, as well as the most ignorant child, are each only welcome in her realms, upon this condition of humility. The inquiry which every one must answer, before his name can be entered on the students' roll, is simply, "Are you willing to abjure all prejudice, all pure imaginations, all systems, and observe and reflect upon plain and simple facts?" An absolute and affirmative answer is the only one which science will condescend to deem satisfactory. It will thus be seen that common sense and science, or philosophy, are not, as is often absurdly supposed, antagonistic to one another, but that the profoundest philosopher is, after all, but a man of the most plain common sense, and that the man of the most genuine common sense—the *proper* man of the world—is, very often, what he is not supposed to be, even what he feels unconscious of being, a philosopher.

Advance in science may be compared to reading a book. What do we do when we read? Collect ideas, which are but facts presented to the mind in a peculiar way. First, it may be of a single word, as representing a single thing; then of a sentence, then of a paragraph, of a chapter, and so on to the greater, but simple and single idea, that the whole book (if written as a book should be written) is intended to convey; being that, in the majority of instances, which, in all probability, originally suggested its composition to the author's mind. We thus first collect a few heterogeneous facts; these, by the mysterious spell of some general truth, are bound into one. Again, other facts, of a character more heterogeneous still, perhaps, present themselves. A more enlarged law combines them all with the preceding; and so on, until we find our knowledge extended to a law which associates together in a common disc, or field of brotherhood—found after seeking for it—the most apparently opposite things; and which, like that most general law of gravitation, establishes, by the same process in the scientific mind, the certainty of a like cause operating to force a heavy substance to the earth, or to elevate a light one into the air: for the light one (as a balloon) does not rise because it is lighter than the atmosphere, but because the atmosphere surrounding it is attracted with greater force to the earth.

We may here observe, that nothing can be more temporising, more servile, than the exclamation of the mere man of the world—the mere man of business—the mere self-seeker, that science is too abstruse; that his want of a proper education precludes him from its prosecution. Whoever attaches this idea to science errs deplorably; for science must, as we have already attempted to enforce, be the most simple matter to attain to, provided common sense and industry be applied to the attainment. There is no royal road, no short cut, to it; but her path is open to all the world alike. Her truths are too valuable for gold or rank to purchase; but nature yields them to all who diligently observe. As discoveries greater and greater shall be made of nature's operations, more and more simple must each enlarged rule or law be found, until, having penetrated to the adytum of her temple, man will see and know, and feel and acknowledge, that science may be attained and appreciated by the unlearned as well as the learned, and that simplicity is the beautiful zone which encircles all things.

It is unnecessary to repeat our suggestion, that the "what to observe," is every thing—every fact—not only in the "physical," but in the "mental" and "moral" worlds; the "how to observe," is that to which the nature of science points.

It would be but wasted time to run over a catalogue of the various fields of inquiry, to which the name of science has been applied. Besides, our object is not at present to analyse knowledge. The reader need not be told that its name is now Legion; yet a very little reflection will tell him that, however the sciences may appear separated—marked out by metes and bounds—in encyclopædiæ and otherwise, no such separation exists in nature. Each flows truly into others, and all are connected together in a Great Oneness.

For some such purpose, possibly, as the more ready acquisition of elementary truths—haply the economy of power—the course of nature has hitherto been, to cause man gradually, more and more, to aphorise, or cut, his more general observation and thought into more particular observation and thought. The number of sciences has, therefore, increased as science has extended her empire. We may instance the three sciences of jurisprudence, morality, and the mind. Although these, ever since learning has had a name, have been separated in all schools, it is, upon the slightest consideration, obvious, that, without some science of the mind, a science of the moral sentiments could not be, and without the latter, jurisprudence, founded alone upon justice, could have no place.

We may be allowed in this place to say a few words upon the different significations which have been attached to the terms, science and philosophy. Science has ordinarily been held to apply to investigations into particular fields of "physics,"* or the "material world;" philosophy, to the co-relation of these investigations. Very little, however, has hitherto been taken in by either of them, of metaphysics and ethics, or the mind and feelings. These different applications of the term have been occasioned by circumstances to which we cannot at present further allude. And it is unnecessary to remark upon the palpable absurdity of one-sided philosophies—if we may be allowed the expression—modes of treatment obviously erroneous. How is it possible that a physical theory, as distinct from a mental theory and a moral theory, can possibly be entitled to any authority? and yet, in all our universities, in every school in which philosophy is assumed to be taught, this is the principle acted upon. Has not each, in truth, to deal with facts alone? The one, indeed, may include the facts of external nature, and the other those of consciousness and the conscience; and in this view, the philosophies which treat of mind and morals are, so far as regards the *formula* of such treatment, precisely in the same position as the sciences which treat of matter. All are, and, to be of any worth, can but be, inductive. We may dispute about facts as we may; but with plain facts it is, that both the scientist and the philosopher has to deal. Hence, every man of science must be a philosopher, and every philosopher a man of science; and as we conceive correctly the present meaning of terms, those of philosophy and science will be used, for any useful purpose at least, as if they had ever been synonymous.

Having thus touched upon the nature of science, let us consider its objects or aims. Its first object is, doubtless, the improvement of the human race; its lowest, the personal gratification of the individual. But so intimately has this pleasure been associated with grander effort, that when it is even unconsciously worked out, its intensity has often been experienced; while, in the probably few instances where self is sacrificed, or willing to be sacrificed, for the enlargement of human happiness, it is the highest bliss that virtue and intellect combined may know. For in thus ministering to the tone and natural course of things, man walks again, as it were, erect in the garden, and is in constant communion with his Maker. This improvement is to be traced by gradual steps in superior power—physical, mental, and moral combined; and it is its character to endow human life, at every successive stage of its existence, "with new inventions and new riches."* That knowledge is power, was the favourite thought of the great Bacon; but this illustrious man qualified his expression by saying, that bare power and knowledge, in themselves, exalt rather than enrich human nature.† For he saw that they might be used, as in many instances they are, for the mere purposes of temporary self, and not for the establishment of lasting laws for the benefit of man in general, during the long life of the human race. Cuvier expressed the truth yet more definitely, when he declared the true object of science to be, to lead the mind of man towards its noble destination—a knowledge of truth; to spread sound and wholesome ideas among the people; to draw human beings from the empire of prejudice and passion; and to make reason the arbiter and supreme guide of public opinion.‡ It is, to quote again, what we cannot quote often enough, the magnificent language of the great instaurator of all real learning, "to extend the knowledge of the secret motions of things, and to the enlarging of the bounds of human empire, to the effecting of all things possible."§ It is scarcely necessary to say, that utility (which was the only watchword of the celebrated Bentham) thus forms, although not the sole object or aim, one of the companions of science, as does that at which all our efforts tend, true and substantial happiness.

* "Nov. Org.," L. i., Aph. 81. Dr. Abercrombie, on the Intellectual Powers, says, "The objects of true science are facts alone, and the relations of those facts to each other," 11th ed., p. 27; do. pp. 436, 437. Metaphysically speaking, he is, doubtless, right; "object" referring to what the mind contemplates, as "subject" does to that which contemplates. But, in ordinary language, the foundation of the sciences (which we have above endeavoured to show to be facts, and facts alone) is certainly distinct from the aim or end for which the sciences exist, as the materials of a building are essentially distinct from the purposes for which the building is erected.

† "Nov. Org.," L. i., Aph. 89.

‡ See "Penny Cyclop."—*Cuvier*.

§ "New Atlantis."

NOTE ON THE CONSTRUCTION OF SAILING VESSELS.

By J. P. Joule, Esq., F.R.S.

Since the now far by-gone times of Peter Pett, the great improver of naval architecture, the general form of ships' rigging has remained unchanged, or, at least, without any material alteration. In our finest vessels we have still the lower, top, and topgallant masts, supported by their respective shrouds and stays. The sails belonging to these masts have still pretty much the same contour; and although attached to the yard throughout the entire length of the head, they are only secured by the corners of the foot, or the clews, to prevent chafing with the stays.

This general form, sanctioned by the experience of centuries, is probably the best which could be employed with wood as the material for the mast; for the capabilities of wood, in resisting a crushing force, are so trifling, that it would be impossible to work a mast of it without lateral support from ropes. With iron, the case is different. The experiments which led to the execution of the Britannia and Conway tubular bridges, have safely demonstrated the great strength of hollow tubes of that metal, and have induced the adoption of the tubular system of metallic construction, in a constantly-increasing variety of forms and uses. Of such applications, I am convinced that one of the most important will eventually be in the construction of masts of sufficient strength, to support themselves without the extraneous aid of the usual standing rigging. A conical tube of wrought-iron, six feet in diameter at its base, and with plates an inch thick; or, what would be still better, two concentric tubes, each of half-inch plates, and riveted together by means of intervening strips of metal, or transverse stays, would advantageously replace the mainmast and shrouds of a ship of 2000 tons. The weight would be the same, and thus, so far as "top-hamper" is concerned, no disadvantage would result. It is also obvious, that the upper parts of the mast might be constructed to slide within the lower parts, so as to secure the conveniences occasionally derived from lowering the topmasts of an ordinary ship. The following advantages may be expected to arise from the use of the iron self-supporting mast:

Fig. 1.

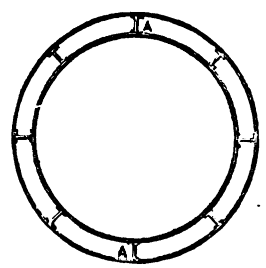


Fig. 2.

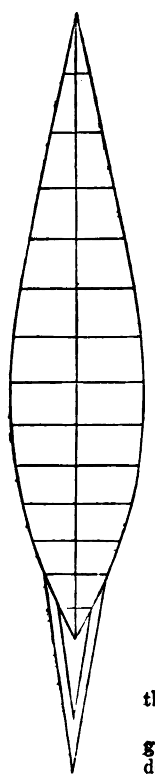
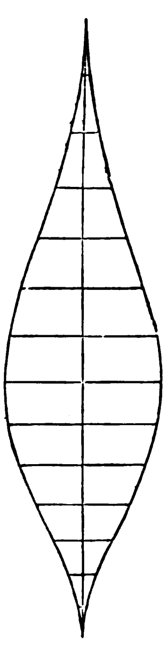


Fig. 3.



1st. Its strength would be greater than that of its timber competitor, whilst it would, at the same time, be more evenly distributed.

2d. Less resistance would be opposed to the wind, in the ratio of about 2 to 3.

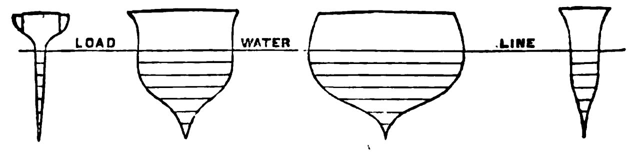
3d. In consequence of the absence of the stays and shrouds, the foot of each sail might be attached to the yard at several places in addition to the clews, and thus a greater effective area of canvas would be obtained, and the tendency to "balloon" would be prevented.

4th. The yards might be braced up to as small an angle with the keel line as the seaman could possibly desire, and hence the sails would be turned to the best advantage when sailing on a wind.

Fig. 1 of the engravings represents a horizontal section of my proposed duplex concentric tubular mast, taken near its base, the tubes being each of half-inch iron, riveted together by the stays, A.

Figs. 2 and 3 represent the deck and load-water lines of a ship on Russell's wave system, in which the fullness of the stern, in comparison with the bow, is given, by reducing the distances of the ordinates of the curve from one another in a geometrical ratio. The sections of the ship, as delineated in fig. 4, are also designed with the view of giving the utmost

Fig. 4.



possible lateral resistance, combined with the least possible resistance in the line of the ship's progress.

[Masts of tubular wrought-iron have already been used to some extent, but only, so far as we are aware, for large steamers. One or two large iron ships, of Clyde build, have been so fitted, but we are not in possession of their actual details of construction, or their behaviour at sea. Telescopic bowsprits, to work on the principle proposed by Mr. Joule for striking the topmast, have also been patented by Mr. Borrie, but they have not yet come into regular use, although we know that the weight of such constructions in tubular wrought-iron is only two-thirds that of the same details in pine. It is, in fact, scarcely possible to overrate the advantages derivable from such a system of construction, for, whilst greater strength is obtainable, with less dead weight, than when timber is used, the telescopic plan furnishes great facilities in the transport of vessels in harbour, as well as in easing their labouring at sea, and enabling them to carry a press of sail much longer. In bowsprits, the jibboom running inside keeps the strain directly on the centre, and obviates the severe twisting strain usually experienced at present in a sea-way. Masts and spars also partake more or less of these advantages. Besides, the great losses from the natural decay of timber, and the heavy expense of replacing sprung bowsprits, lower and topsail yards, must be enormously diminished with the employment of tubular iron; and the great improvement in appearance, in comparison with the confessedly clumsy bowsprit, jibboom, and topmasts, is a point by no means to be disregarded.—Ed. P. M. Journal.]

AYR DREDGING MACHINE.*

SPECIFICATION OF ENGINE AND MACHINERY.

The motive power consists of a condensing, side-lever, marine steam-engine, having a cylinder 26 inches diameter, and adapted for a 30 inch stroke. The sole plate and condenser a single casting; the former extra strong, and securely attached to bearers by eight bolts, 1½ inch diameter, and the latter one-third the capacity of the cylinder. The entablature for supporting the inner end of crank-shaft cast in one piece, resting on four malleable iron-turned pillars, 4 inches diameter, securely fixed into sole plate and entablature; and two malleable iron-turned stays, 3½ inches diameter, with squares planed for bracket of wiper shaft and parallel motion, between, and securely fixed to, entablature and cylinder. The pillars braced fore and aft by three crosses of malleable iron, each in one piece and finished, two in height being placed at one side, and one at the other above the air-pump. The nozzles cast on the cylinder, with a short three-port bridged valve, with spring at back, and covering not more than ⅜ of an inch when shut. The condenser fitted with an injection cock, and copper pipe ⅛ of an inch thick, and an index at the starting platform; and an extra cock with copper pipe and rose, so that bilge water may be used to condense the steam, if required. The steam-piston metallic packing (with rings not less than three in height) of the most improved construction; and the cylinder fitted with two spring priming valves, two grease cocks, one being placed on the nozzles, and a blow-through valve, workable off the starting platform.

The radius bars, cranks, crank-shaft, and side rods, of malleable iron, turned, and of such a construction as to insure a truly vertical motion to the piston rod. The air-pump cylinder of brass, not less than ⅝ of an inch thick, and 18 inches diameter, and adapted for a 15 inch stroke. The bucket, with pot-lid valve, of brass, with which metal the malleable iron piston rod of the air-pump is cased for a thickness of ⅜ of an inch. The crosshead of the air-pump sliding in parallel guides, and having side rods to connect it with the levers, and so made that it shall work the bilge and force pumps, the former being 4 inches diameter, and the latter sufficiently large to feed the boiler, and both with brass ram plungers ½ an inch thick; the bilge pump connected with a copper pipe and rose. The hot-well attached to the top of the air-pump, and having an air-tight cover and stuffing-box, and a copper air 'scape pipe leading to outside of vessel, fitted with a brass discharge valve acting on a brass facing, fixed on a cast-iron frame. The foot valve and its facing of brass. The eccentric strap of brass. The governor of the best construction, and adjusted to regulate the engine to 38 strokes per minute; driven by a three-inch leathern belt, from a pulley on the crank-shaft, and a pair of finished mitre wheels. The side levers 8 feet long between the centres, and each formed with two malleable iron plates, each ½ an inch thick, fitted with malleable

* See *ante*, page 54, Vol. V., *P. M. Journal.*

iron centres and studs, and firmly riveted together; the levers keyed on a malleable iron shaft, 5 inches diameter, oscillating in double brass bushes, fixed in pillow blocks, cast on sole plate. The steam-piston and air-pump crossheads, the cross-tail and its straps, the piston side rods and connecting rod, of malleable iron, turned, and slotted or planed. The crank-shaft of malleable iron, with journals 7 inches diameter and 9 inches long, and having a finished malleable iron crank, 15 inches long between the centres, shrunk hot on it. The supply, feed, and waste water pipes of force pump made from hammered copper, $\frac{1}{8}$ of an inch thick, joined with brass flanges, and vulcanised india-rubber rings, and screws; the feed pipe with a valve in the boiler, and a cock fitted on it between waste pipe and boiler; and the waste pipe with a valve loaded to exceed the working pressure in the boiler. The steam pipe from boiler to cylinder, and the waste pipe from hot-well to outside of copper, $\frac{1}{8}$ of an inch thick. The engine to be completely balanced by a fly-wheel, 10 feet diameter over the hem, 12 inches by $4\frac{1}{2}$ inches, and cast in six segments, well fitted and bolted to as many arms attached to centre, bored, and fitted to crank-shaft with key and feather. All the bearings working in brass bushes, the bottoms and tops varying from $\frac{1}{2}$ an inch to 1 inch thick, according to the places where they are to be used, and fixed with covers securely bolted down. The collars for stuffing-boxes of brass, with which metal the covers are bushed all their depth. A water guage, also a mercurial steam pressure and a condenser guage, of the best construction, fitted in a mahogany case, with locked glass door, attached to a convenient position in the engine-room; and the boiler fitted with a bell-whistle, to give the alarm when the flues are covered with two inches of water. The engine finished "bright," well fitted, finished, and proportioned in all its parts; and such portions as are not "bright," painted with copal green. A brass rail, two inches diameter, fitted up the whole breadth of the fly-wheel, so as to guard the starting platform. A cast-iron stair, with brass hand-rail, constructed between the deck level and engine floor.

Gearing for Driving Upper Tumbler.—The bevel pinion $39\frac{1}{2}$ inches diameter, with teeth $8\frac{1}{2}$ inches broad, and set to a $2\frac{1}{2}$ inch pitch, turned on the ends and points of the teeth, and pitched, chipped, and filed (or slotted) smooth and fair; the eye bored and fixed on crank-shaft: this pinion gearing with a bevel cog-wheel, 91 inches diameter, with cogs same breadth and pitch as its driver; the cogs made from the best horn-beam, completely seasoned, and thorough warded with iron pins; the hem 4 inches deep, and all turned; the mortise divided in two by a bridge $\frac{5}{8}$ of an inch thick; but the cogs, although in two pieces each, joining close and fair in the middle; this wheel provided with a friction, 50 inches diameter, and 9 inches broad, with four arms, (the wheel eight arms.) The rim of centre, and eye of wheel, also the flanges, turned and faced on both sides, and eight pinching screws, 1 inch diameter, and finely threaded, passing through the inner hem, screwed into nuts recessed in same, and bearing with a rounded point on cast-iron slips fitted in, and bored out with the eye, for pressing on hem of centre. This cog-wheel fixed with eight keys on lower end of cast-iron inclined shafting, extending from engine-house to upper tumbler; this shafting of cast-iron, with journals $6\frac{3}{4}$ inches diameter, and 9 inches long, running in top and bottom brass bushes, 1 inch thick at the crown, and secured with cast-iron covers, bolted down to strong bracketed pillow blocks, firmly attached to wooden framing, and the lower end of the shaft abutting on a hardened steel plate. This line of shafting in four lengths, faced at the joinings, and connected with concealed catch couplings, the ends of the shafts thereat being let $1\frac{1}{2}$ inch into the face of the coupling. The fore coupling made to disengage, by a means of a forked lever, steeled on the palms; each end of the shaft having squares 7 inches on the side, planed parallel for key seats of cog-wheel and stern bevel pinion, the latter of which is fixed with eight keys, and is 27 inches diameter, with teeth $8\frac{1}{2}$ inches broad, and $3\frac{1}{4}$ inches pitch, and driving a bevel wheel 6 feet diameter, fixed with eight keys on a malleable iron shaft, forged square, and planed parallel at the key seats, with turned journals $8\frac{1}{2}$ inches diameter and 10 inches long, and shoulders projecting $3\frac{3}{4}$ of an inch, and on which shaft the upper tumbler is fixed with eight keys in each end; it consists of a single casting, 35 inches long through the centre, having flanges 39 inches diameter, and about 2 inches thick, both of which are hooped with rings of Low-moor iron, 21 inches diameter over, 4 inches broad, and tapering from $1\frac{1}{2}$ inch to $\frac{3}{4}$ inch thick, which rings, after being turned, are shrunk hot into a groove turned out of the flanges. The tumbler fitted with four bars, forged from malleable iron, and set to the proper distance for pitch of chain; each bar fixed with two bolts and six keys, having seats 3 inches deep at the ends; the soles of the bars 5 inches broad, and made to bear their whole length, the sides and soles planed, and the ridge laid with steel $\frac{3}{4}$ inch thick. The lower tumbler consists of two cast-iron flanges, 52 inches diameter, and about 2 inches thick, strengthened with arms opposite to the four key seats, $5\frac{1}{2}$ inches long, and keyed on a cast-iron shaft, with chilled journals, $6\frac{1}{2}$ inches diameter, and $5\frac{3}{4}$ inches long, working in cast-iron bushes, set in blocks fixed in lower straps; the shaft with four-sided necks, 6 inches long, for flange key seats, also ruffs, $\frac{3}{4}$ of an inch square. The lower tumbler fitted with six cast-iron bars, (the ridges of which are hardened by being cast in chill plates,) pitched to the proper distance for chains, supported in recesses cast on inside rim of flanges, and fixed thereto with a screw bolt, 1 inch diameter, and two keys at each end.

Dead Eyes.—Two strong cast-iron dead eyes, 14 inches diameter outside, with a bearing 4 inches long, for upper straps, bolted through side flanges into the framing, and further secured to same by having slips cast on the ends vertically, and checked in.

Frame Pillow Blocks.—Two pillow blocks, fitted with brass bushes, 2 inches thick, and protected by covers set at an angle of 40° with the framing, resting on and keyed to horizontal flanges of dead eyes, and securely bolted through same into framing.

Frame.—The main sides of the frame in one length each, and made of the best quality of Quebec red pine without blemish, cambered 3 inches on the upper edge, $15\frac{1}{2}$ inches deep at the belly (5 feet forward of the middle), and curved to 12 inches at the ends, uniformly $6\frac{1}{4}$ inches thick, 45 inches broad over, and the length required for 29 buckets. The main sides fished on the lower edges with the best American white oak without blemish, extending from end to end in one length, close jointed, flush with frame at the edges, and tapering from $6\frac{1}{2}$ inches deep at the belly, to 2 inches at the upper, and to an edge at the lower end of the frame. The frame braced with 11 cross ties, the lower one of British oak, and the others of Quebec red pine, all 5 inches thick, and the depth of the main sides at the several places where they are fixed; attached to frame by a double tenon, 2 inches long, and each with 1 inch bolt passing close alongside, and bearing on malleable iron washers, 4 inches diameter, and $\frac{1}{2}$ inch thick, for heads and rivets, all of which flush with outside of frame; the bottom tie further strengthened by having an upper and lower gib, 5 inches broad, and $1\frac{1}{4}$ inch thick, strongly fastened. The straps for lower end of frame of malleable iron, forged and planed out to the proper shape for seats to blocks of lower tumbler bushes, and eyes for truss and side rods forged on; these forged ends welded to straps 5 inches broad, and tapering from $1\frac{1}{2}$ to $\frac{3}{4}$ inch thick, at 2 feet beyond the centre of the frame, and fixed down at distances of 20 inches apart with screw bolts, decreasing in diameter from $1\frac{3}{8}$ inch to $\frac{3}{4}$ inch, and the ends of the frames abutting on malleable iron plates, 1 inch thick. Of the straps for the upper end of the frame, the upper ones extend 8 feet down the frame, and the lower ones extend down the frame till they meet the lower straps from the lower end of the frame, and with which they are dove-tail joined; fixed down with bolts, as above described, uniformly 4 inches broad, by a thickness of 1 inch at lower ends, increasing to $2\frac{1}{4}$ inches at the shoulder, where they change to 3 inches, and continue this size for the length required, to give the adjusting blocks a travel of 15 inches in planed grooves, the straps to be connected at the head of each frame by a tie 4 inches by 2 inches, all in one piece, as well as an eye for end of truss rods; the points of the straps at the upper end screwed and passed through a flanged cover, 4 inches broad by $1\frac{1}{2}$ inch thick, fixed down with nuts; between the top straps the bolts are screwed on washers 4 inches square. The blocks for resting on the dead eyes in halves, made of malleable iron, and rebated half-an-inch, to slide in grooves planed in straps; the upper block bored, to allow the screw to pass clear through, and the lower threaded throughout, to suit the screws. Four malleable iron screws fitted in, of the proper length, 2 inches diameter at the body, and cut to a half inch pitch, with a square thread beveled to the point; the heads of the screws hexagonal, and 2 inches long on the side, and a close key sufficiently powerful to work these screws easily, and fitting neatly to the heads; malleable iron counter-nuts, 2 inches deep, fitted on screws for fixing down upper adjusting block.

Trussing Rods.—The middle tie of malleable iron, 6 inches broad, and $1\frac{1}{2}$ inch thick at the body, and set up at the ends so as to have the same sectional area at the 4 cotter holes as at the body, this tie kept 43 inches below top surface of frame, by a strong cast-iron strut properly secured to frame; four malleable iron rods, each 2 inches diameter, to extend in one length from mid tie to ends of frame, the inner ends forked, and attached with gibs and cotters to mid tie, and the other ends set up, and after passing through eyes, fixed there with gibs and cotters, the full sectional area of the rod being preserved at both attachments. The rods rise to an eye sweet curve on two cast iron struts, firmly fixed to frame.

Rollers.—The rollers for carrying the bucket chain, 10 in number, of cast-iron, 26 inches long, with a thickness of metal of $\frac{1}{2}$ of an inch at the body, and 2 inches at the ends, chamfered; an eye, $2\frac{1}{4}$ inches square, cast in the end, into which a malleable iron spindle $1\frac{5}{8}$ inch square is fixed, with 4 single hooked gibs and 8 wedges at each end; the spindles with journals, $1\frac{1}{2}$ inch diameter, and 3 inches long, laid with steel and hardened, and working in cast-iron bushes, with hardwood cover, set in brackets attached to frame, with 2 bolts, $\frac{3}{4}$ inch diameter to each, and passing through oval holes, so that the rollers may be shifted to keep the chain on them.

Extra Hoisting Chains.—Each side of the bucket frame with a short link chain, made of iron $\frac{3}{4}$ inch diameter, fastened at the lower end to an eye bolt, and loosely attached to cross-ties with staples, and extending 30 feet up the frame, so as to lift the same, should any part of the purchase give way.

Gearing for Hoisting Frames.—The shaft all of malleable iron, the diameter of the journals being, for the upright shaft, 4 inches, lying shaft athwartships $4\frac{1}{2}$ inches, and shaft in line with barrel, and also the barrel shaft, 5 inches; the power transmitted by a pair of mitre wheels at the crank-shaft, 2 feet diameter, with teeth $4\frac{1}{2}$ inches broad, and 2 inches pitch; a bevel pinion, 14 inches diameter, on lower end of vertical shaft, gearing with a wheel, 24 inches diameter, on starboard end of lying shaft, the other end of which carries a bevel pinion, 14 inches diameter, with teeth $5\frac{1}{2}$ inches broad, and $2\frac{1}{2}$ inches pitch, working into a wheel 62 inches diameter, with teeth same breadth, and $2\frac{1}{2}$ inches pitch; this latter wheel fitted with a friction 42 inches diameter, but otherwise finished and fitted, as before described, for cog-wheel friction, the eyes of friction square, and fixed on shaft with eight keys. The after end of shaft, carrying the large bevel wheel, turned, with two feathers dove-tailed into it, for guiding and holding shifting catch for coupling on to barrel shaft; this catch bearing 8 inches on shaft, and has 4 snugs, $2\frac{1}{2}$ inches deep, and 5 inches long at the root, with a diminishing taper to the outside of $\frac{3}{4}$ of an inch; the collar of the catch turned, with a forked lever with steeled palms working in it, the upper end standing 51 inches above deck, with a hinged locker to retain it in gear. The brake-wheel 43 inches in diameter, and $4\frac{1}{2}$ inches broad over the lists, which are half-an-inch square, and all turned; its centre 8 inches long, bored out, and fixed on barrel shaft, which is turned, with a ruff at back of brake, to prevent it shifting with the strain on the coupling; the brake-wheel with 8 arms, and a ring cast in them, with 4 snugs on the foreside of it, for the coupling on the opposite shaft; the strap of the best rolled iron, $3\frac{1}{2}$ inches broad and $\frac{1}{4}$ inch thick, and lined with well-

seasoned beech in staves 4 inches broad, $\frac{7}{8}$ of an inch thick; the end pieces being attached to straps with 4 screws, and the intermediate staves with 2 screws each, all inserted from the outside; the joints for the lever and adjusting screws firmly riveted to straps, all the joints and pins bored or turned, and the adjusting screw $1\frac{1}{4}$ inch diameter, and finely threaded. The fulcrum bracket strong, and securely attached to hull; the joints 2 inches apart centres, and the lever 51 inches above the deck, and held by a weight, not exceeding 56 pounds, suspended to a compound lever sufficient to sustain the frame when at work. The barrel 5 feet long, the flanges 28 inches diameter over, and $1\frac{1}{4}$ inch thick; and the body $19\frac{1}{2}$ inches diameter, and $1\frac{1}{4}$ inch thick, with a central feather inside. The eyes square, and each fixed with eight keys, having a bearing of $4\frac{1}{2}$ inches long on the shaft, which is made so much longer, that the barrel may be shifted 8 inches either way on it, to suit the angle of the hoisting chain. The journals of this gearing $1\frac{1}{2}$ diameters long, working in double brass bushes, $\frac{3}{4}$ inch thick at top and bottom, and held down with covers, bolted to pillow blocks, fastened in strong cast-iron stools, firmly attached to keelsons, and the lower end of the vertical shaft resting on a steel plate. The purchase consists of three upper and two lower sheaves and a chain, viz.:—The lower block forming part of a malleable iron crosshead, forged in one piece, the sides of the sheave frame measuring 10 inches deep, and $1\frac{1}{2}$ inch thick, with ends of a proportionate size, flattened for jaws of side rods. The bridge between the two sheaves of malleable iron, half-an-inch thick, tapered and driven from under side into a slotted groove. The sheaves 12 inches diameter, with a flatly rounded groove, made of the proper width for chain. The centres bushed with soft steel, and bored out, and run on a pin 2 inches diameter, cased with steel, turned and hardened. The side rods of malleable iron, 4 feet long, 3 inches diameter at the ends, and swelled to $3\frac{1}{2}$ inches at the middle, with forked ends, set at right angles to one another, and attached to lower crosshead and eye of top lower strap, by pins 2 inches diameter, secured with a stout cotter to each. The upper block and crosshead consists of a single casting, each side of the sheave frame being 12 inches deep, and $1\frac{1}{2}$ inch thick, with upper and lower webs, 4 by $1\frac{3}{4}$, and 8 by 2 inches respectively, and divided by two bridges, each $\frac{3}{4}$ inch thick. The ends terminate in turned trunnions, 5 inches diameter, and 5 inches long, protected by covers bolted down, and resting on pillow blocks, cast on the top of strong cast-iron shears, braced transversely, and connected together with two malleable iron plates, $\frac{1}{2}$ an inch thick, firmly bolted, and extending 6 feet down from the top. The feet of the shears spread, and resting on and fixed to well and waist keelsons; and panels cut out of the plates diagonally, to lighten them, but so as not to impair their strength. The sheaves for the upper block similar to those already described, with the exception of the central one, which is 18 inches diameter. These sheaves run on a pin similar to the one for the lower block, the centre of it 8 inches under the axis of the trunnions. The hoisting chain of short link chain, made of Govan B best iron, $1\frac{3}{8}$ inch diameter, of the best materials and workmanship, and proved to a strain of eight tons. This chain in one length, and sufficiently long to immerse the centre of the lower tumbler 15 feet, and leave three turns on the chain barrel.

Pitch Chain and Buckets.—The bucket chain composed of a pair of double and a pair of single links alternately, 22 inches long between the centres. Twenty-nine buckets complete form the chain, each of which has 2 double and 2 single links, and 4 pins and cotters. The pins of octagonal bars of hammered iron, laid with steel $\frac{3}{8}$ of an inch thick, and 3 inches long, for bearing of single links, and forged to a parallel diameter of $2\frac{1}{4}$ inches. The pins with six-sided heads, a feather in each, to prevent turning in the double link, and a split cotter. The single links 3 inches deep, and $2\frac{1}{4}$ inches thick at the body, with a bearing of 3 inches broad on the pins; the extra thickness there being made up with a washer welded on each side. The double links with forked ends, made from bars 3 inches deep, and 2 inches thick, welded to body 3 inches deep, and $1\frac{3}{4}$ inch thick. The backs of the links 1 inch thick, welded on; when finished, the double links being 3 inches deep, the same as the single links. All the eyes steeled with the best spring steel. The backs of the buckets $\frac{1}{2}$ inch thick, and secured to each link with nine rivets $\frac{7}{8}$ inch diameter. The body of buckets $\frac{3}{8}$ inch thick, and the bottom $\frac{1}{2}$ inch, with water-holes in it, all well riveted together, at distances of $2\frac{1}{4}$ inches apart centres, or thereabouts, and well caulked. The mouth-pieces $1\frac{1}{4}$ inch thick at the point, and taper to $\frac{3}{8}$ inch thick at the ends, and laid with steel at the forge for a length of 30 inches at the middle, by a breadth of 2 inches, and a thickness of $\frac{1}{2}$ inch. The three lower rivets of the mouth-piece flush. Of the buckets, the back made of Bowling or Lowmoor iron, and the rest of Monkland or Dixon's best plate; and the links and pins either Bowling or Lowmoor, or the best hammered scrap iron.

Forward Motion.—The forward motion consists of two pulleys, connected by a belt, driving change wheels, from which the motion is communicated to the bow crab, by 2 inch shafting and mitre wheels. A pulley, 24 inches diameter, and $6\frac{1}{2}$ inches broad, within the flanges, turned at the hem, and bored and faced at the eye, fixed on crank-shaft, and connected with a similar pulley on the first driving shaft by a leathern belt, 6 inches broad, joined with small copper rivets, and fitted with a stenting pulley, 12 inches diameter, and $6\frac{1}{2}$ inches broad, within the flanges, turned on the hem, and fitted to slide in a frame, with two adjusting screws. The first driving shaft 3 inches diameter at the body, and $2\frac{1}{4}$ inches at the journals, and having a groove in it for keying on a boss or hollow shaft, bored and slotted throughout, and turned, and on which are fixed three pinions, of the respective diameters of 14 inches, 10 inches, and 6 inches, so as to gear with three wheels of 18 inches, 22, and 26 in diameter respectively, all 3 inches broad, and $1\frac{1}{2}$ inch pitch. The change wheels fixed on second driving shaft, driving a pair of mitre wheels, 18 inches diameter, $3\frac{1}{2}$ inches broad, and $1\frac{1}{2}$ inch pitch, from which the motion is communicated to the bow crab by three pairs of mitre wheels, each 14 inches diameter, $3\frac{1}{2}$ inches broad, and $1\frac{1}{2}$ inch pitch, fixed on malleable iron shafting, $2\frac{1}{2}$ inches diameter at the key seats, and 2 inches diameter at the journals, two diameters long, and running in brass bushes, fixed in brackets strongly attached to vessel. The bow crab double powered, with strong cast-iron framing, securely attached to fore and aft carlins and main deck beams; the shafts of malleable iron, with journals 5 inches long, and double ruffs; all except the barrel shaft running in brass bushes, held down by covers bolted to frame. The first shaft 2 inches diameter, the intermediate one $2\frac{1}{4}$ inches diameter, and the barrel shaft $2\frac{1}{2}$ inches diameter at the journals, and on each end of the latter a cast-iron surging head. A pinion, 5 inches diameter, 4 inches broad, and $1\frac{1}{2}$ inch pitch, fixed on first shaft, and working into a wheel 14 inches diameter, and 3 inches broad, fixed on intermediate shaft, the other end of which has a pinion, 5 inches diameter, 4 inches broad, and $1\frac{3}{4}$ inch pitch, to work into a wheel 24 inches diameter, and 4 inches broad, fixed on barrel. Two crank handles fixed on a spindle $1\frac{1}{2}$ inch diameter, with two shifting pinions of the diameter and pitch required to gear into the opposite wheels, so as to work either single or double power by hand when required, and for this purpose a slip clutch is fitted to slide on two feathers, fixed in a turned part of the first shaft, also the necessary catches and ruffs. A friction strap with lever fixed on starboard frame, so as to command the barrel wheel. The chain barrel 9 inches diameter at the middle, and curving to 16 inches at the flanges, over which it is 3 feet long; four malleable iron whelps fixed to it, with screws counter-sunk, and tapped in every 6 inches; snugs, 8 inches diameter, cast on each end of barrel, and turned, and on which the barrel wheel and a rachet is fixed, with a key and feather to each; the ratchet of malleable iron, 14 inches diameter, and 2 inches broad, turned at the eye, shrunk hot on snug, and fitted with three palls; a guard fixed on frame, to prevent the working chain falling on the ratchet.

Stern Motion.—The stern crab fitted up so that it may be worked by the engine when required, or by men at the crank handles in single or double power. A pulley, 28 inches diameter, and 7 inches broad, within the flanges, fixed on crank-shaft, and carrying a leathern belt, $3\frac{1}{2}$ inches broad, joined with copper rivets (and adjustable with a stenting pulley, 12 inches diameter, and 7 inches broad), which gives motion to a pulley, 14 inches diameter, fixed dead on end of lying shaft, and from which—when it is required to disconnect the stern crab from the engine—the belt may be shifted to a loose pulley alongside (of the same diameter, and running on the shaft) by means of a forked handle with lever passing outside. The shafting from the engine-house to the crab of malleable iron, in three lengths, half lapped at the joinings, and connected with thimbles and keys, and running in four bearings, each $1\frac{1}{2}$ inch diameter, and 3 inches long, and consisting of brass bushes, fixed with covers to hanging brackets attached to deck beams, and the after bracket also serving as a step for upright shaft, to which motion is communicated by means of a pair of mitre wheels, 10 inches diameter, $3\frac{1}{4}$ inches broad, and $1\frac{1}{2}$ inch pitch; and on the upper end of this shaft, motion is given to the barrel wheel by a bevel pinion, 12 inches diameter, 4 inches broad, and $1\frac{3}{4}$ inch pitch, gearing into a bevel wheel, 30 inches diameter, keyed on barrel; the pinion bored out loose on shaft, and fitted with slip clutch and handle, to throw out of gear, when required; the barrel 21 inches long, 7 inches diameter at the middle, and curving up to 14 inches at the ends, and fitted with four malleable iron whelps; snugs, 8 inches diameter, cast on ends of barrel, for holding bevel and spur wheels at the one end, and a wrought-iron ratchet, 14 inches diameter, and $1\frac{1}{2}$ inch broad, and fitted with three palls, at the other. The handle shaft $1\frac{3}{4}$ inch diameter, the intermediate shaft 2 inches diameter, and the barrel shaft $2\frac{1}{4}$ inches diameter at the journals. A pinion, $4\frac{1}{2}$ inches diameter, 3 inches broad, and $1\frac{1}{2}$ inch pitch, fixed on end of handle shaft, and gearing into a wheel, 13 inches diameter, on end of intermediate shaft, the other end of which carries a pinion, same as first described, to gear with spur wheel, 27 inches diameter, fixed on barrel snug. A pinion, same breadth and pitch as barrel wheel, and of the diameter required to work it, is fixed on crank-shaft, to work the crab in single power by hand, when required; a surging head fixed on outer end of barrel shaft, and slip clutches, ruffs, catches, bushes, and covers, as well as the general construction, similar to the bow crab already described.

Windlass.—The windlass with strong cast-iron framing, with knightsheads, and firmly secured to deck; the barrel 32 inches long, 7 inches diameter at the body, and 12 inches at the flanges; a ratchet cast on one end of barrel; at the other end, and keyed to a 2 inch shaft, is a spur wheel 24 inches diameter, 3 inches broad, and $1\frac{1}{2}$ inch pitch, gearing with a pinion, 5 inches diameter, fixed on spindle, the journals of which are $1\frac{1}{2}$ inch diameter, and work in brass bushes, held down by covers bolted to frame, in which a 5 inch carrying roller is fitted, to save the deck from the working chain. Oak surging heads, 12 inches long, from 6 to 10 inches diameter, and hooped at the ends, fixed on ends of barrel-shaft; and similar ones, but only 9 inches long, and from 4 to 7 inches diameter, with cast-iron ratchets, fixed on crank spindle.

Crab Winch.—A single powered crab winch of an approved design, with cast-iron surging heads, and the crank spindle working in brass bushes, fixed by covers, fixed down at the starboard quarter.

Hand Pump.—A hand pump of an approved design, with a double lever, and 5 inches diameter, having copper chambers and brass buckets, fitted with the necessary copper pipes, brass cocks and valves for filling or emptying the boiler; and having a copper branch pipe, with a brass cock and a rose on it, at the centre of the vessel, for pumping bilge water by hand.

Boiler.—The boiler 10 feet broad, 8 feet 6 inches long, and 5 feet high at the crown, and the steam-chest extending 18 inches high above the deck. The two furnaces, each 4 feet long and 2 feet wide, having cast-iron chairs, with shelves for fire-brick bridge walls, and cast-iron bars $\frac{5}{8}$ of an inch thick, with $\frac{3}{8}$ inch draft spaces, and resting at the mouth of the furnace on 3 inch angle iron, returned 6 inches down the sides, and fixed with two rivets at each end there. The sides and roofs of the furnaces, and for 8 inches beyond the bridge walls, also the angles of flues, of the best Lowmoor or Bowling iron, $\frac{7}{16}$ of an inch thick; the bottom,

and 10 inches up the sides, $\frac{3}{8}$ of an inch thick, and the rest $\frac{5}{16}$ of an inch thick, and of the best Scotch plate; the furnace and ash-pit plates in one length, and the butts of the rivets there, inside of the ash-pits and furnaces; the plates with landings $2\frac{1}{2}$ inches broad, well caulked on the outside, the $\frac{5}{16}$ inch plates having $\frac{5}{8}$ inch rivets, 2 inches apart centres, and the $\frac{3}{8}$ inch plates $\frac{11}{16}$ inch rivets $2\frac{1}{4}$ inches apart centres. The under side of all the flues stayed to bottom with bosses and bolts 2 feet apart, and the sides and ends stayed with five stays of a similar description. The furnace doors made of $\frac{1}{2}$ inch malleable plate iron, with damper plate, fire-brick cover, and hinges and catches complete. A man-hole, and two sludge holes, with doors and fixings, fitted in front of boiler. A $2\frac{1}{2}$ inch flanged cock, fixed to bottom planking, and having a flanged copper pipe $\frac{1}{8}$ of an inch thick, and 6 feet long, attached to it and boiler, near the front, and at the mid line thereof. A brass plate fixed on front of boiler, with cocks and stuffing-boxes for a glass tube 16 inches long, fixed so that the upper side of the lower stuffing-box shall be 2 inches above the flues; and a guage cock screwed on at 8 inches above flues. The boiler has two coats of the best red lead. A waste steam-pipe, 4 inches diameter, made of hammered copper, $\frac{1}{16}$ of an inch thick, 11 feet long, and fixed with two brass hoops to funnel, connected with waste steam-chest, which is attached to the steam dome, and provided with a direct action safety valve, loaded to $3\frac{1}{2}$ lbs. on the square inch above the atmosphere, and the seat, valve (5 inches diameter), and rod, of brass. The funnel 20 feet high, and 26 inches diameter, made from plates $\frac{1}{8}$ of an inch thick, butt-jointed and flush-riveted throughout, having the inside vertical straps in one length, 3 inches by $\frac{1}{4}$ inch, and the horizontal joints covered on the outside with funnel iron; and having a damper with rack, a crance with pulley, and five chain stays, with tightening screws, and the whole painted black. A case, 3 feet 6 inches high, and 33 inches diameter, fitted on the steam dome round the funnel. A complete set of boiler fire-irons, consisting of a clawt, a poker, two hammers, and four shovels. The boiler proven to be steam tight, under a pressure of 12 lbs. on the square inch above the atmosphere, by filling it with water to the proper level, and raising the steam before it leaves the contractor's yard; and resting on four malleable iron girders of patent I iron, 6 inches on the side, and $\frac{1}{2}$ an inch thick, bolted to keelsons, turned up at the ends, to prevent the boiler shifting athwartships, and slips riveted to the bottom of the boiler, to prevent this taking place fore and aft.

Hurries.—A hurry, consisting of a shelf of malleable iron, $\frac{1}{2}$ an inch thick, and strengthened with two ribs of 3 inch angle iron, suspended from the frame by two arms, $2\frac{1}{2}$ by $\frac{3}{4}$, and two chains, $\frac{3}{4}$ inch diameter at the outer angles; and a timber hurry, of an approved construction and materials, to be used when working in sludge.

Patterns.—The patterns well finished, and made from well-seasoned timber; the teeth of the wheels being made of white planetree, dovetailed into the hem, and the undernoted patterns being well painted, numbered, and inventoried, and delivered in good order to the Harbour Trustees at Ayr, on the completion of the work, viz., wheels, pinions, bushes, upper and lower tumblers complete, rollers and brackets, furnace bars, pulleys, and the necessary core boxes for these patterns, also the chill plates for bars.

Quality of Materials.—The dimensions given are understood as the sizes finished. The body of shafts, and the side of the square of square key seats thereon, are as large at least as the diameter of the largest journal on the same shaft, an increase of size being made, where required, for key seats and ruffs. The diameters given for the wheels and pinions are understood as the diameter to the pitch line of the teeth, and they are made as near the pitch given as the diameter will admit of, and the teeth of the wheels of the epycycloidal form. Unless otherwise specified, the wheels and pinions, also the pulleys, are fixed to the shafting, with a key and feather to each, the eye being bored and faced, and the key-seat turned, and ruffs worked on the shaft where necessary. All the cocks of brass. The machinery, unless otherwise specified, painted with three coats of the best oil paint. The metals of the different kinds of the best quality, and such as are cast, of the most suitable alloy for the several purposes intended.

THOMAS ORMISTON.

THE NEW PATENT LAW.

BY JOHN HENRY JOHNSON, SOLICITOR AND PATENT AGENT.

This act having already made its appearance in full, in many of our contemporaries, we think our readers will derive more benefit from a general statement of the changes which it effects, and the machinery through which it acts, than from a mere copy of the act itself. This is the more obvious to us, as the act is by no means particularly clear to the comprehension even of those most accustomed to the construction of the statutes; and it would be still more unintelligible to the majority of our readers, who do not probably number amongst them many members of the legal profession. Hence, the following translation may perhaps be found worthy of acceptation.

COMMISSIONERS.

The Lord Chancellor, the Master of the Rolls, the Attorney and Solicitor-Generals for England and Ireland, the Lord Advocate and Solicitor-General for Scotland, and such other persons as her Majesty shall appoint, are to be "Commissioners of Patents for Invention;" any three of whom (the Lord Chancellor or Master of the Rolls being one) may act.

The commissioners are to have a seal of office, and are to make rules of practice, to report annually to parliament, and to appoint such clerks and officers as they may think proper.

PROVISIONAL PROTECTION.

A petition, declaration, and provisional specification, very similar to the documents at present required on petitioning for letters patent, are to be left in the commissioners' office, and to be referred by them to one of the law-officers, who will have the power to call scientific assistance to his aid. If the law-officer approves of the title and provisional specification, both of which he can allow or require to be amended, he is to give a certificate of such approval or allowance, which is to be filed in the commissioners' office, whereupon the invention may, for six months from the date of the petition, be used and published without prejudice to any letters patent to be granted for the same. The entire expense of this proceeding, including agency, fees, &c., will probably amount to £10. 10s. As the validity of the patent will principally depend upon this provisional specification, it will be necessary to frame it with the greatest care and consideration.

Instead of the proceeding last described, the applicant for letters patent may file, with his petition and declaration, in the commissioners' office, a complete specification of his invention; whereupon, a certificate of the filing having been given him, the invention is protected for a period of six months, as before. Any letters patent granted, therefore, are to contain a clause, conditioning them to be void if this specification does not fully describe the invention; a copy of the specification is to be open for public inspection from the time of its deposit. The commissioners are to cause these "protections" to be advertised as they may see fit. The expense of this protection will of course vary in every case, with the nature of the invention, and the amount of trouble or skill required in preparing the specification and drawings, if drawings are necessary: the actual payment to government will be £10.

COMPLETION OF THE PATENT.

When the applicant is desirous to complete his patent, after either of the preliminary steps before described, he is to give the commissioners notice to that effect; the application is then to be advertised, and parties desirous of opposing the grant are, within such time as the commissioners shall appoint, to leave with the commissioners notice in writing of their grounds of opposition. When the time for this purpose has expired, the applicant's provisional or complete specification, and the particulars of objection, are to be referred to the law-officer to whom the application has been referred; the law-officer is to decide upon the matter as he may think fit, and, if he deems it advisable, he has the power to decide by whom the costs of the application, reference, and hearing (if any) shall be paid. After the law-officer's decision, he is to issue his warrant for the sealing of the patent; the warrant is to be sealed with the commissioners' seal, and is to set out the clauses and restrictions to be contained in the grant. The same power is reserved to the Lord Chancellor as to the making and issuing of patents under this warrant, as he possesses under the present system; and power is also reserved to her Majesty, by warrant under her royal sign manual, to direct the law-officer to withhold his warrant, or to direct that no letters patent shall issue under his warrant, or to direct the insertion in the letters patent of any provisions or restrictions she may think fit, and also to direct any complete specification which may have been filed, to be cancelled, upon which the protection obtained shall cease.

The letters patent are to be void unless £50 be paid at the end of three years from the date thereof, and £100 further at the end of seven years. Certificates of these payments are to be issued under the commissioners' seal, and receipts therefor to be endorsed on the letters patent; such certificates to be legal evidence of the payments.

After the sealing of the warrant, and when required by the applicant, which must be within three months from the date of the warrant, the commissioners are to cause letters patent to be prepared, and the Lord Chancellor is to affix the great seal thereto; such letters patent extending to the United Kingdom of Great Britain and Ireland, the Channel Islands, the Isle of Man, and such of the Colonies as have been specially petitioned for, and are named in the warrant. These letters patent are to be of the same effect as the three distinct grants now are. One transcript of the letters patent is to be entered in the Records of Chancery in Scotland, in the same manner, and to the same effect, as letters patent for Scotland now are; and copies of, or extracts from, such transcripts are to be received as evidence in the Scotch law-courts, with the same effect as the letters patent themselves. Another transcript is to be transmitted for enrolment in the Chancery Enrolment Office in Dublin, and is to have the same effect in Ireland as letters patent for that country solely now have. Letters patent are not to issue, unless granted

during the period of preliminary protection already fully described, except in case application has been made to seal the letters patent, and such sealing has been delayed by reason of a caveat or application to the Lord Chancellor against their being sealed, or in case of the death of the petitioner during the continuance of the preliminary protection, under which circumstances the executors or administrators of the applicant may obtain the seal within three months after his decease.

Letters patent may be sealed as of the day of the date of the application, or, in case of any invention protected under the "Protection of Inventions Act, 1851," the act passed for the protection of inventions exhibited at the 1851 Exhibition—as of the day of the provisional registration, or of the day of the sealing of the letters patent, or, in the discretion of the Lord Chancellor and the law-officer, of any other day between the day of application or provisional registration, and of sealing: but, *except in case a complete specification has been filed with the application*, no legal proceedings can be adopted for infringements committed before the patent was actually sealed. This is a very important provision, and for this cause it may be desirable, in some cases, to file a complete specification with the application.

SPECIFICATIONS.

Specifications are to be filed instead of being enrolled, and all provisional and complete specifications filed in the commissioners' office shall, immediately on the completion of the letters patent, and where no patent is issued, then within six months from the date of the application, be transferred to the office in Chancery, where specifications are to be filed. If drawings are alluded to in the specification, two copies of such drawings are to be left with the specification.

Copies of all specifications, disclaimers, memoranda of alterations, and provisional specifications, after the expiry of the term of their provisional protection, are to be open for inspection at the office of the commissioners, and at offices in Edinburgh and Dublin.

Specifications, disclaimers, and memoranda of alterations, are to be printed and published, and sold as soon as conveniently may be after their being filed; and the commissioners may present copies thereof to such public libraries and museums as they may think proper, and the patentee may have twenty-five copies of such publications without any charge; and these copies, printed by the Queen's printer, are to be *prima facie* evidence of the existence of the originals in all law-courts. The proceedings now in operation, under the Acts 5 and 6 Wm. IV., c. 83, and 7 and 8 Vict., c. 69, as to disclaimers, memoranda of alterations and confirmations, are to be applicable to letters patent obtained under this act.

REGISTERS.

The office in Chancery, where specifications are to be filed, is to keep a "Register of Patents," wherein will be recorded, in chronological order, all letters patent granted under this act, the deposit or filing of specifications, disclaimers, and memoranda of alterations, all amendments, all confirmations and extensions, the expiry, vacating or cancelling letters patent, with their dates, and all other matters affecting the validity of patents, as the commissioners may direct.

The same office is to keep a "Register of Proprietors," wherein is to be entered, as the commissioners shall direct, the assignment of any patent, or of any interest therein, any licence, and the district to which it refers, with the name of any person having any interest in such patent or licence, and the date of his acquiring the same, and any other matter relating to the proprietorship; and copies of such entries, certified under the seal of the office, shall be received as *prima facie* evidence of such transactions. Until such entries have been made, the original patentee is to be deemed the sole party interested. Duplicates of the entries in the "Register of Proprietors" are to be open for inspection in Edinburgh and Dublin.

Any person obtaining a false entry in the register of proprietors is deemed guilty of a misdemeanor, and will be punished accordingly; and any person deeming himself aggrieved by any entry therein, may apply, by motion, to the Master of the Rolls, or to any of the courts of common law at Westminster, in term, or to a judge in vacation, for an order to expunge, vacate, or vary such entry, which may be ordered. We consider these provisions to be of great importance, as at present there is no method by which information as to dealings with patents can be obtained.

PATENTS FOR FOREIGNERS.

Where an application is made under this act for the United Kingdom, in respect of any invention *first invented in any foreign country*, or by the subject of any foreign power or state, and a monopoly therefor has been obtained in any foreign country before the date of letters patent for the United Kingdom, the British patent is to become void immediately upon the determination of the foreign patent, or where several foreign patents have been obtained, upon the expiration of the first of such foreign patents; and no patent granted for an invention for which a patent has been obtained abroad, and has expired, is to be valid in the United Kingdom. This clause will render it very desirable for foreigners, or Englishmen resident abroad, to obtain their British patent before doing anything in the country where they are resident. We are afraid the alteration in this respect, which appears to be quite uncalled for, will be a source of great trouble to foreign patentees. No British patent is to extend to foreign ships within British ports, except in the case of ships belonging to foreign countries whose laws will prevent the use of their subjects' inventions by British ships whilst in the ports of such foreign countries.

AS TO PATENTS APPLIED FOR BEFORE PASSING OF ACT.

Patents may be granted on applications made before the passing of the act, as if the act had not passed; and where letters patent for England, or Scotland, or Ireland, have been granted before the passing of the act, or are in respect of any application made before the passing of the act, hereafter granted for any invention, letters patent for England, or Scotland, or Ireland, may be granted for such invention as if the act had not passed, except that, in place of the existing fees, there shall be paid for each country a sum equal to one-third of the total fees to be paid for the United Kingdom under this act.

FEES AND STAMP DUTIES.

The under-mentioned fees and stamp duties are to be paid. The stamp duties are to be under the control of the Commissioners of Inland Revenue, and the provisions of the present Stamp Acts are to be applicable thereto. The fees to be paid into the receipt of the Exchequer, and are to form part of the Consolidated Fund. The law-officers' fees, in cases of appeals, oppositions, disclaimers, and memoranda of alterations, are to be paid as heretofore, and the Lord Chancellor and the Master of the Rolls are to determine the fees to be paid the law-officers, and also the charges for office copies, certificates, &c., to be granted under this act.

Persons now holding offices abolished by this act are to be compensated.

Fees.	£	s.	d.
On leaving petition for grant of letters patent,	5	0	0
On notice of intention to proceed with the application,	5	0	0
On sealing of letters patent,	5	0	0
On filing specification,	5	0	0
At or before the expiration of the third year,	40	0	0
At or before the expiration of the seventh year,	80	0	0
On leaving notice of objections,	2	0	0
Every search and inspection,	0	1	0
Entry of assignment or licence,	0	5	0
Certificate of assignment or licence,	0	5	0
Filing application for disclaimer,	5	0	0
Caveat against disclaimer,	0	2	0
Stamp Duties.			
On warrant of law-officer for letters patent,	5	0	0
On certificate of payment of the fee payable at or before the expiration of the third year,	10	0	0
On certificate of payment of the fee payable at or before the expiration of the seventh year,	20	0	0

There are some clauses relative to legal proceedings upon letters patent, of which no abstract is given, as it is thought they would not be very intelligible to inventors and intending patentees, for whose information only we have prepared this abstract.

SUMMARY OF CHIEF ALTERATIONS.

In place of a separate, most expensive, and tedious process for each kingdom, one grant of letters patent will extend to the whole of the United Kingdom; and one specification only of the invention will have to be filed.

A preliminary protection will be given for a period of six months, at a slight cost, within which period an inventor will have the opportunity of publishing and of testing the actual merits of his invention.

Letters patent will be granted on a scale of fees payable at three periods—on obtaining the grant, at the expiration of three years, and at the expiration of seven years, instead of the total amount having to be paid on the commencement, as at present.

The practice is thus assimilated to that of the principal continental states, as the costs of obtaining protection are, as it were, proportioned to the success of the invention. For, if successful, or promising to be so, at the end of three years, the patentee will gladly pay the additional sum required, whereas, if unsuccessful, he very naturally will not.

PRUSSIAN NEEDLE GUN.

Dr. KUFAHL, PATENTEE, LONDON.

Fig. 1.

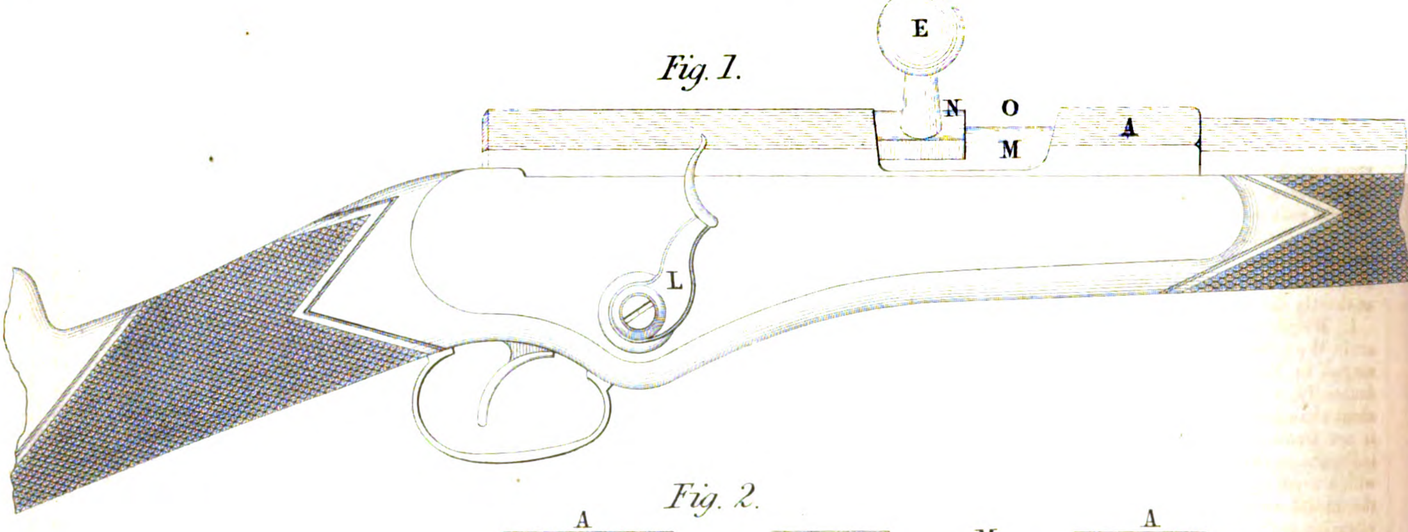


Fig. 2.

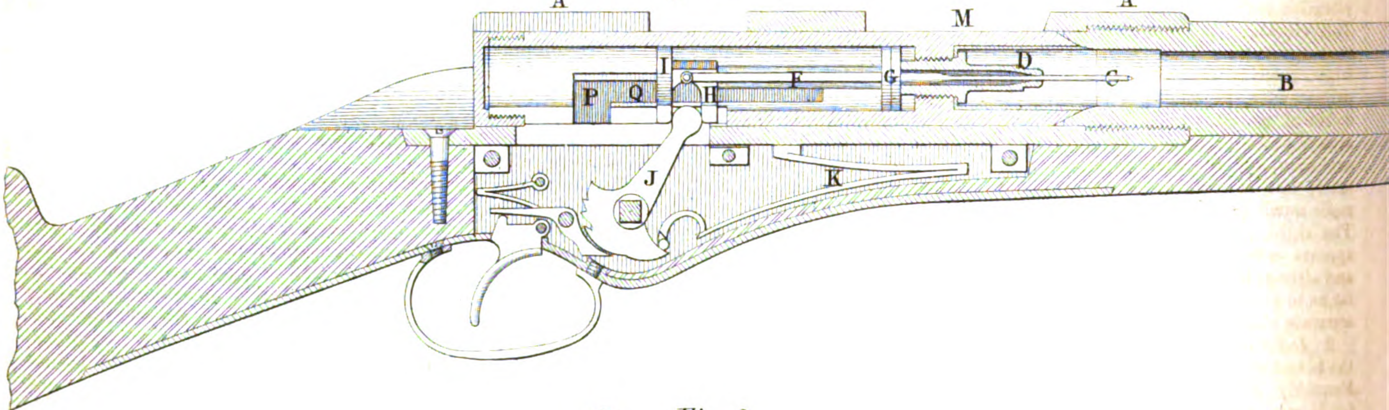


Fig. 3.

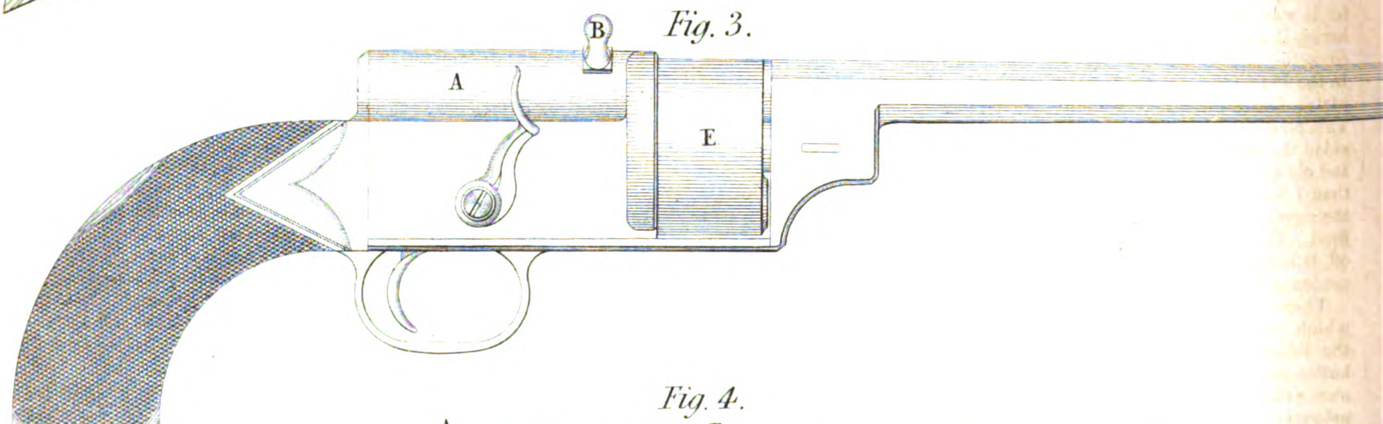
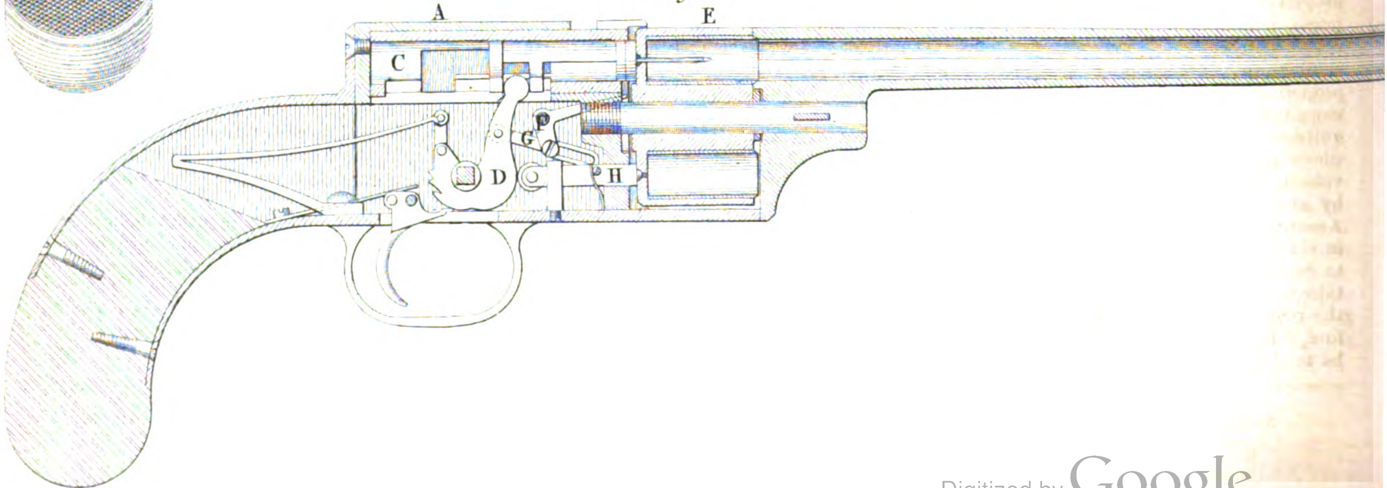


Fig. 4.



KUFAHL'S IMPROVED PRUSSIAN NEEDLE-GUN AND REPEATING PISTOL.

(*Illustrated by Plate* 104.)

Dr. Kufahl's original invention of the "needle-gun," has already been fully figured and described in the *Practical Mechanic's Journal*,* but our present supplementary paper on the inventor's recently patented improvements thereon—including the application of the "needle" principle to revolvers, or repeaters—will be found to embrace several totally original points of invention. These points, it may be safely said, have now brought this arm much nearer perfection; and, indeed, with them the needle-gun is a really efficient, accurate, and serviceable weapon. Before entering upon a detailed account of the figures on our plate, let us shortly discuss rifles and rifle-shooting in general.

1. *Weight of the Weapon.*—Whilst the Swiss, Americans, and Germans are in the habit of using heavy rifles, at least for target-shooting and long ranges, in England lighter ones are almost constantly preferred. Undoubtedly, a rifle of eight pounds weight is much more easy to carry about than one of twelve; but there is reason to doubt whether lightness is not frequently carried too far in this country. Theoretically, it is indisputable that the explosion of the powder—pushing the bullet forward with a force equal to about 1500 atmospheres—must throw the fibres of the metal composing the barrel into vibration, and, practically, this vibration is felt, and its effect appreciated, by the experienced marksman. This vibration, or commotion of the barrel, must be the stronger, and its tendency to lessen the accuracy of firing must be the more powerful, where there is less weight and strength of metal in the barrel, in comparison with the weight of the bullet and the charge of powder. This defect of too light rifles usually is not much noticed, because there is always strength enough in the barrel to save it from bursting by the explosion, and the want of accuracy in firing is ascribed to some other fault; but in artillery, cannon which are to throw solid shot are always made much heavier than those intended for shells of the same diameter. The right proportion between the weight of the gun and its charge appears to be an object well worth the attention of the gun manufacturer, and although lightness should be aimed at, it should never be carried so far as to endanger that quality for which a rifle is carried at all, namely, accurate shooting.

2. *Different Modes of Rifling.*—The object of providing the interior of the barrel with grooves, forming elongated spirals, is familiar to every one. Formerly, five or seven, or any odd number of grooves were the fashion, for it was supposed that the bullet would take the firmer hold of the barrel, if a groove were always opposed to a prominence on the other side. Since the introduction of the belted ball, this notion has been exploded. In the Prussian rifles, the interior of the barrel is divided into eight equal parts—four for the grooves, and the rest for the prominences or ridges. This plan, which is also adopted in France, will do as well as any, provided the other conditions are fulfilled, and it has the advantage of easy and cheap workmanship. The depth of each groove should not be less than 1·5-100ths of an inch, for grooves of too little depth are apt to lose their grip of the bullet, especially after a number of shots have been fired. The internal corners of the grooves should always be well rounded off, it being well ascertained that sharp indentations have a dangerous tendency to destroy the cohesive force of the metal.

There is great difference of opinion as to the pitch, or class of spiral, which ought to be given to the grooves. The question may be put in the following words:—As we know of no better means of keeping a bullet steady in its flight, than to give it a spinning motion around its own axis of flight, how many such turns ought the bullet to make while progressing a certain distance, in order to overcome the disturbing forces, namely, the resistance of the air, and imperfections in its own shape and centre of gravity? Commonly both causes of disturbance combine, and, unfortunately, almost in every single case in a different proportion. As the average velocity of a common rifle bullet is little more than 300 yards in the first second, one should think it might be quite enough if the bullet were whirled round its own axis about 150 times during so short an interval. It would seem that a greater velocity of rotation could only impede the progress of the moving body, by absorbing an undue share of the propulsive force of the powder. Accordingly, the pitch of the spiral grooves of the French rifles is one turn in six feet, or two metres. On the other side, if a range of 600 yards is to be taken instead of 300, by the same rifle and charge, the bullet will take more than double the time to accomplish this distance, and the slower the motion, the more potent the disturbing forces grow. A pitch, therefore, fully enough, or rather a little in excess, for short distances, may be too little for long ranges. According to Dr. Kufahl's experience, at least with the needle-gun, he finds that somewhat more spirality than the French allow makes a better shot, even although the velocity of the bullet of the needle-gun is much greater than that from the "carabine-à-tige," and the (so called) "Minié."

Another question is—"Ought the grooves to be regular portions of internal screw threads, or ought the pitch to be greater at the breach and less at the muzzle?" The latter form, something like a logarithmic spiral, is given to the rifling of Colonel Colt's pistols, and has been lately carried out in rifles by Mr. Kennedy† of Kilmarnock, and by Mr. Haddan, with great success. In theory, this mode of rifling appears preferable, for the bullet starts forward in a straight line. If, instead of being allowed to take this natural course, it were forced at once into a spiral path, its progress would be impeded, it would be liable to strip, and the gun itself would suffer violent recoil. There is truth in this, and provided the twist of the grooves at the muzzle be just what it ought to be with respect to the number of rotations of the bullet in a given distance, no objection could be raised against the plan, except, perhaps, difficulty of execution. Still there is some error connected with the matter. It is assumed that the bullet flies off at once with great velocity. Now, ocular proof can be given that this is by no means the case. In the needle-gun, where the ignition of the powder is incomparably quicker than in any common gun, the needle, after passing the priming and setting fire to the charge, has full time to enter 1-20th of an inch, or even more, into the bullet itself, before the latter can get out of its reach; thus showing, that even the velocity of the needle, produced merely by a steel spring, and retarded by striking through the powder and the priming, is greater than the initial velocity of the bullet. This shows that stripping can never take place at starting; but, if at all, it must occur after the bullet has got its due velocity—that is, near the muzzle. Nevertheless, the plan of rifling with a decreasing pitch of spiral deserves every attention.

3. *Bullets.*—A great many variations, and certainly some improvements, have been lately made in the shape of rifle bullets. Opinion, however, with respect to their merits, is in a rather unsettled state. The simple spherical ball, the belted and the double-belted, the cylindro-conical bullet, the hollow, with or without an iron or copper cap—each has its advocates. That a single or double-belted ball, or an oval ball, prevents stripping and facilitates loading—if this be done from the muzzle—cannot be denied. The resistance of air, however, which they experience, both sideways in revolving, and lengthwise in progressing, is rather increased by bullets so formed. The cylindro-conical bullet used in the "stielbüchse," or carabine-à-tige, has a good form and sufficient weight, combined with a small diameter, so as to effectually lessen the direct resistance of the air. It need not be feared that this bullet would overturn in its flight, and drop stern foremost, or with its broadside, into the object fired at. If tolerably well proportioned, it will never do so unless all its energy has been spent in too long a range, and it is only moving by the influence of gravity.

The origin of the hollow bullet—mentioned, we think, by Sir Samuel Bentham, but brought into practice by Mons. Delvigne—would seem to be attributable to the supposition, that the cylindro-conical bullet wanted to be lightened behind, in order to keep the point foremost; or a solid cylindro-conical or a sugarloaf-shaped bullet might have appeared too heavy for a certain charge of powder and calibre, and on this account the expedient of hollowing it out be resorted to. It was found in practice that such bullets had the property of expanding, under the influence of the explosive gases in the barrel, and filling the grooves tolerably well, although they were not previously moulded into them. It was afterwards imagined that the introduction of a strong iron cap into the entrance of the hollow, to be driven up to the end of it by the explosion, would greatly augment the expansion of the bullet. The strange stories facetiously told, by apparently practical gentlemen, about the wonders achieved by the Minié rifle—the powers and mysteries of which resided in nothing but this iron cap—are now nearly obsolete. The stanchest supporters of the cap begin to concede that a hollow bullet, of moderately fair proportions, will do just as well with or without a cap—the danger being, indeed, not that there would be too little, but too much expansion, even to such a degree as to leave parts of the bullet behind in the barrel.

Really there is not the slightest difficulty in using hollow bullets, either with or without caps; but they cannot be employed to any advantage either for the needle-gun or the common rifle, especially if they are cast, instead of being made by mechanical pressure. The reasons are obvious enough. A hollow bullet cannot but be always of larger diameter than a solid one of the same length and general outline; it must, therefore, always meet with a stronger direct resistance from the

* Page 174, Vol. IV.

† Page 232, Vol. IV., *P. M. Journal.*

air, which constitutes by far the most powerful impediment to good shooting, and somewhat more resistance at the sides. The iron cap, moreover, will not always be driven up to the same point, and consequently the centre of gravity will vary. These faults are aggravated by casting such bullets, instead of making them by pressure from solid pieces of lead. If cast with the ingot at top, they will be liable to be unsound at the forepart; and if cast from the side, that which was uppermost in the act of casting will be decidedly lighter than the lower one. With a strong charge of powder, it will even sometimes occur that the bullets are blown quite through, or that particles of the hollow portion are separated from the main body, and left behind, either in the barrel or on the way to the target. We can produce ocular demonstration of this seemingly strange assertion.

But whatever shape of bullet may be preferred—the most elegant form will do best—its substance in every case ought to be as solid, homogeneous, and heavy as possible. Now, as lead contracts so much in cooling, and as an admixture of other metals is hardly advisable on account of the increased hardness and diminished specific gravity of the alloy, a good bullet is scarcely procurable by casting. On the contrary, all rifle bullets ought to be cut out of solid bars of pure lead by machinery, and most accurately guaged, so as to fit the bore in the best possible manner. This is invariably done in the Prussian and American services. It will be scarcely believed by gentlemen accustomed to shot-guns only, how much better rifle practice can be had from pressed and guaged bullets. A great deal of bad rifle-shooting may be ultimately referred to the ever-varying density and misplacement of the centre of gravity of cast bullets.

There is another very serious point to be attended to—namely, that all unnecessary friction between the bullet and the inside of the barrel ought to be carefully avoided. It is conceded that, with bodies sliding on one another, friction augments simply as the pressure and velocity increase. But in the rifle this ratio is quite competent, under all circumstances, to destroy an appreciable quantity of the propulsive force of the powder. As far as the barrel is concerned, good workmanship alone can prevent undue friction; but the shape of most of the bullets, especially the elongated ones, is open to great improvement in this respect. That no bullet should be put into a rifle without an adequate supply of grease, is self-evident.

4. *Charge of Powder.*—The quantity and the quality of the charge of powder should, if possible, never be changed in the least degree, after having been fairly ascertained for a certain description of rifle and bullet. It is altogether a bad practice to use a small charge for short, and a large one for long, ranges with the same rifle. The weight of powder for a charge, expressed in parts of the weight of the bullet, depends, in some degree, on circumstances. In the common rifle, where the powder is ignited slowly and from behind, if the charge be great, a part of the powder is commonly thrown out unburt at the muzzle, and consequently goes to waste; in the needle-gun, where the ignition takes place in precisely the contrary manner, this waste is utterly prevented. The needle-gun, therefore, if it were required, might employ a much larger proportion of powder, especially as there is scarcely any perceptible recoil. It will be found, however, that $\frac{1}{8}$th of the weight of the bullet—say, 2 drams of the best powder for a bullet of 1 oz.—is amply sufficient, the bullet being projected with much greater velocity than from a common rifle. Many of the latter could not carry even this proportion of powder, on account of the recoil. A Minié, for example, charged with 3 drams of powder, and a bullet of $1\frac{1}{2}$ oz., would feel rather unpleasant at the shoulder. Theoretically speaking, a bullet of double the weight would not require a double charge of powder for acquiring the same velocity, the resistance of the air to the heavy one being somewhat less in proportion, just as a large vessel wants, comparatively, less steam-power than a small one; but this holds good only when the bullets are of exactly congruent forms.

Great care should be taken not to ram down the powder too tightly, especially not to crush the grain. Gunpowder, in a compact, solid mass, or approaching to that state, will ignite and burn much more slowly, and, consequently, will impart much less projectile force to a bullet, than when the grains are preserved unbroken, and have sufficient interstices between them. It is from this cause that miners mix sawdust with their blasting powder, in order to get a greater effect from it. The carabine-à-tige, and the needle-gun, enjoy the advantage of having the powder quite loose in their respective chambers. There is not the slightest danger of bursting the barrels from this arrangement; for, in the carabine-à-tige, the unoccupied space between the powder and the bullet is only about one-fourth of the space taken up by the powder; and, in the needle-gun, the air-chamber, although somewhat larger, is behind the powder, and, instead of endangering the safety of the gun, greatly tends to preserve it, by easing the recoil.

5. *Sights.*—Much ingenuity has been expended in attempting to make rifle practice more easy and accurate, by improving on the forms and movements of the sights. It would be difficult, and would scarcely answer our purpose, to criticise their different merits, the preference always being given by the individual marksman to that arrangement to which his eye is accustomed. Great care, however, should be taken in shaping the fore-sight, and filing the nick of the back-sight, so as duly to proportion their sizes to each other to their distance on the barrel, and to the range the rifle is intended to take. Of what use, for example, would be a fore-sight of such breadth, that, in shooting at six hundred yards' distance, it would cover one-half of the diameter of a five-feet target; still, such disproportionate contrivances are daily fitted to rifles whose back-sights are graduated for distances up to eight hundred or nine hundred yards. It is the same with the shape and dimensions of the nick in the back-sight, which, if too large, will greatly augment the difficulty of making a correct shot at a very great distance, however convenient it may be for a short range and quick firing.

Perhaps the most difficult thing in rifle-shooting is to estimate the distances correctly. A simple, handy, and cheap instrument, wherewith to measure distances above three hundred yards with tolerable accuracy, is a great desideratum. It may be remarked, however, that the greater the velocity wherewith the bullet is propelled, a less accurate estimate of distances is required.

The improvements for which Dr. Kufahl has lately obtained British and continental patents, are equally applicable to rifles and shot guns, and to single or double-barrelled pieces and repeating pistols. Their object is to render the mechanism of the lock more simple, durable, and safe in handling, and entirely to prevent the escape of gas at those parts of the gun where the charge is introduced, and at the entrance of the needle into the interior.

Fig. 1, on our plate 104, is a side view of the lock portion of a needle-rifle, and fig. 2 is a corresponding longitudinal section of the same. It is shown unloaded, and the cock down. Its great difference from the guns heretofore constructed will be at once perceived, on comparing this section with the woodcuts illustrating an article on the Prussian needle-gun, given in the number of this Journal for November, 1851. It will be seen that merely the outside tube or socket, A, screwed into the barrel, B, the needle, C, the needle-guide, D, and the handle, L, have been retained—these parts being, indeed, common to all needle-guns of the Prussian description. All the other parts have either been wholly laid aside, or modified in such a manner as to suit the cocking power of the lock, which is a flat mainspring instead of a spiral. The needle is screwed into a needle-conductor, F, carrying at its fore part a piston, G, well packed with an elastic material, and provided behind with a stud, H, and a disc and stud, I. To give motion to the needle by means of the needle-conductor, a tumbler, with a rounded head, is employed, actuated near its centre of motion by a flat mainspring, K, a sear, searspring, and trigger, and connected, outside of the gunstock, with a cocking lever, R. In the position of the tumbler and cock, shown in the drawings, taking place whilst the cock is uncocked, or in the act of exploding the charge, the head of the tumbler rests on the stud, H, forcing the needle-conductor and its piston up against the prominent part of the needle-guide, and by this means preventing the escape of gas at this point, which is otherwise always very serious and detrimental, especially with strong charges. The head of the tumbler, in this position, stands up in corresponding slots in the outside fixed tube, A, and the inner moveable tube, M, and consequently prevents the latter from being turned, or otherwise moved. Now, in order partially to withdraw the inner tube from the outside one, the abutment, N, must be first brought opposite a longitudinal slot on the left side of the outer tube; hence it follows, that the breech of the gun can never be opened, wilfully or by accident, either in the act of firing, or for the purpose of introducing a charge, while the needle is protruding into the interior of the gun. This arrangement constitutes one of the means provided for insuring perfect safety in handling the gun.

To open the breech, for introducing a charge through the loading hole, O, the tumbler, in the first instance, must be brought to half-cock. Its head, during this movement, acts on the face of the studded disc, I. of the needle-conductor, and draws the needle out of the way into the needle-guide. At half-cock, the head of the tumbler is opposite a transverse slot, P, at the left side of the inner tube, made to receive it freely; and, consequently, this tube may now be turned to the left by means of its handle. This being accomplished, the shoulder below the handle will stand opposite the left-hand longitudinal slot of the outside tube or socket, and the inner tube may now be slid backwards, so as to uncover the loading-hole, the head of the tumbler meanwhile lodging in a second longitudinal slot, Q, of the inner tube, and connected with the transverse one. It will be perceived, that, while loading, the tumbler is out of all connection with the needle-conductor, and this is the second feature of safety.

After loading, the inner tube must again be pushed forward, and its shoulder, N, firmly interlocked with the outside socket, before the tumbler can act on the needle-conductor. This being done, the gun may be brought to full cock for firing; and while in this state, the head of the tumbler again prevents the inner tube from being turned, and the loading-hole from being opened. It is now evident that this gun is much safer in handling than any other whatever, it being impossible to open the breech for loading or any other purpose, or to fly open of its own accord, as long as the tumbler, mainspring, and trigger, have any communication with, or power of action on, the needle.

In order to facilitate the cleaning of the gun, very simple means are provided for instantly withdrawing the inner tube altogether, and replacing it with the least possible trouble. To withdraw the inner tube, having previously brought it to that position which is required for loading, draw the cock to the last bend, over full cock. The head of the tumbler will now be altogether out of the way of the inner tube, and this may be instantly removed. To reinsert it, leave the cock and the tumbler in the last position, insert the tube, bring it into the position for loading, go to half-cock, and shut the loading-hole.

To prevent the escape of gas at the joint between the forepart of the inner tube and the barrel, a thin elastic tube of metal is introduced into the chamber of the former, which, fitting into the barrel, and being expanded by the explosion, stops the gas as effectually, and on the same principle, as the leather collar of the ram of an hydraulic press prevents the escape of water. These tubes will serve for a long time, and may be easily replaced by new ones after being worn out.

Besides greater safety, simplicity, and durability of the parts, and ease of handling, there is the advantage that it may be instantly ascertained, from the position of the cocking-lever, whether the lock is uncocked, or at half, or at full cock. All other needle-guns are very troublesome in this respect.

The movements for practice are,—1. Bring the lock to half-cock; 2. Open the loading-hole; 3. Introduce the cartridge; 4. Shut the loading-hole; 5. Go to full cock; 6. Take aim and fire.

If firing be not immediately wanted, the lock is returned to half-cock, and kept in that state while loaded. This position is preferred, not because it would be impossible to make the cock go down fully without giving the tumbler a purchase on the needle—such means are actually provided in the repeating pistol—but because half-cock is really the state in which every rifle should be kept while loaded and primed. The movements from 1 to 5 may each be performed in a second of time. Taking aim, requires, of course, somewhat more, but six shots may be fired in a minute without any over-exertion.

It may be well to state, that cartridges, although presenting the easiest and quickest means of loading, are not absolutely required for these guns.

As an example of the application of the improvements to pistols, a side view (fig. 3) and a longitudinal section (fig. 4) of a repeating needle-pistol, are given in our plate. The outside tube or socket, A, is provided at the top of its foremost part with a longitudinal and a transverse slot, for the reception of the knob or handle, B, of the inner tube, C. The lower part of the outside tube forms a rectangular box for the reception of the tumbler, D, the mainspring, the sear, and those parts by which the disc, E, containing the charges, is made to revolve. The pistol is represented as not loaded, and the cock down.

In order to load, the tumbler must be brought to half-cock, by which movement the needle is withdrawn from the uppermost chamber of the disc or magazine. Next, the knob or handle is to be turned over to the left, whereby the head of the tumbler is disengaged from the studs of the needle-conductor. The disc may now be revolved by hand, and the charges, consisting of powder and a primed bullet successively introduced into the chambers, taking care to put a small washer of paper over the hole where the needle does enter. This done, and the handle being still in the left-hand position, the cock may be let down. The head of the tumbler then moving forward in the left-hand longitudinal slot of the inner tube, and being disconnected from the needle-conductor, and the priming contained in the inside of the chambers, it is perfectly impossible to discharge the pistol, which may be put into the pocket and carried, or even knocked about, with the utmost safety.

To prepare for firing, bring the tumbler again to half-cock, and move the handle into the right-hand position shown in the drawing. Going to full cock will revolve the disc one-sixth part, by means of a small elbow lever, F, and a connecting-rod, G. One shot may now be fired, and the other five in quick succession, by going at once to full cock and pulling the trigger.

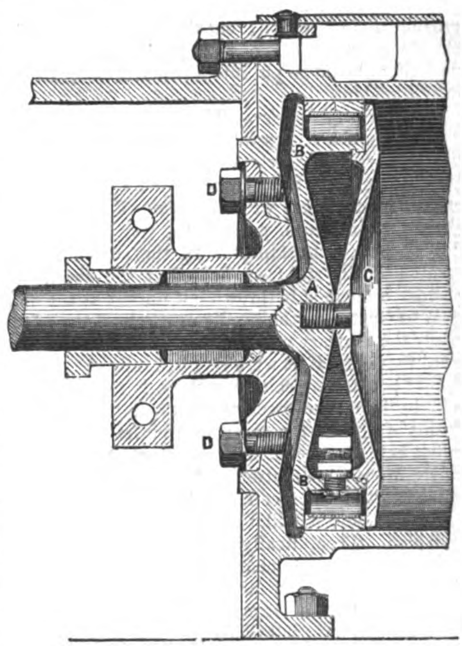
The means of preventing the escape of gas, namely, the packed piston of the needle-conductor, and the thin metal tubes of the chambers, are the same as employed in the gun. To bring the fore part of the tube into the barrel, and keep it steady there whilst the explosion takes place, a strong horizontal bolt, H, is made use of. This bolt is always in contact with the disc at one end, and with an enlarged part of the tumbler at the other. Whilst the pistol is at half or full cock, the disc and the bolt are kept back by the action of a spring situated between the disc and barrel, and the metal tubes are clear of the latter; but as soon as the trigger is released, the prominent curve of the tumbler forces the bolt and disc forward, pushes the metal tube into the barrel, and firmly shuts the joint before the needle can reach the priming and explode the charge. The recoil of the disc is taken off, not by the mainspring, but by the strong axis of the tumbler, the bolt being in a straight line with it. The bolt, moreover, steadies the disc in revolving, and provides that a needle-hole shall always be in its right place for the needle to enter into.

Means, not shown in this drawing, are also provided for preventing the charges from being moved in their chambers from the recoil, which very often takes places in other repeaters, and is the cause of miss fire.

The facility with which arms on this principle may be loaded, must be a most important consideration in the eyes of the sportsman, as well as the man of war. With the needle-gun the deer-stalker may load when lying flat down with as much ease as when erect—a proceeding which the redoubtable Gordon Cumming himself declares to be somewhat of a feat. To this is to be added, the increased range, economy in powder, and absence of recoil, all which are grand requisites in shooting.

M'CONNELL'S WROUGHT-IRON PISTON.

This is a further modification of the wrought-iron piston given in our plate 103, and described on another page in the present part. It is shown in transverse section in the annexed figure as fitted to a locomotive engine cylinder. The body, A, is forged in one piece with its rod, and has a deep circular projecting ring, B, upon it, as in the former example. The loose plate, C, has a shallow ring corresponding, for screwing on by, and both are dished very considerably, so that they come in contact at the centre, where a bolt holds them together. The cylinder-cover, either of wrought or cast-iron, is held on by the bolts, D, the cylinder itself being forged with a closed end, having a central hole large enough to receive the cover flange. The details are sufficiently obvious from the sketch.



MECHANIC'S LIBRARY.

Bridgewater Treatises (Bohn's Scientific Library), vol. 2, 12mo., 5s.
Civil Engineering, vol. 3, part I., 12mo., 1s., cloth. H. Law.
Designing, Artificer's Works, Student's Guide to, 2d edition, 9s.
Drawing-Book, The Illustrated London, 8vo., 2s., cloth.
Electricity, On Animal, edited by Jones, 6s., cloth. Du Bois-Reymond.
Engineer and Contractor's Pocket-Book for 1852-3, 12mo., 6s., tuck.
Geometry, Key to Elementary Course of, 12mo., 2s. 6d., cloth. J. Elliot.
Magnetical Illustrations, vol. 2, 8vo., 16s., cloth. Rev. W. Scoresby.
Mathematical Geography, Manual of, 2d edition, 4s. 6d., cloth. Hughes.
Naval Dry-docks of the United States, 4to., £2, cloth. C. B. Stuart.
Planting, Practical Hints on, fcap. 8vo., 5s., cloth. Standish & Noble.
Practical Lithographer, 12mo., 2s., sewed. L. Mason.
Shipbuilding, Outline of, 3d edition, 8vo., 31s. 6d., cloth. Fincham.
Steamers, Economy of Fuel on Board, 8vo, 5s., cloth. Capt. Ryder.

RECENT PATENTS.

TREATMENT AND FINISHING OF TEXTILE FABRICS.

JAMES AIKMAN, *Paisley.—Enrolled July* 20, 1852.

The ornamental fringes of shawls, and other bordered fabrics, have a large amount of tedious manual labour expended upon them, for the apparently trifling purpose of giving them the even, curled twist, without which no shawl is deemed wearable. Up to the present time, the only implement which has been used for this purpose, even in the largest and most completely organized establishments, is a small holding-frame to receive a given outstretched length of fringe; whilst a girl imparted the necessary twist to each portion of threads by her fingers.

This slow process is now superseded by Mr. Aikman's twisting machine, in which he substitutes mechanical dividers and twisters for the human hands. The machine contains, within a long rectangular frame, an upper and a lower vertical traversing-beam, actuated by double cranks and connecting-rods from the driving-shaft below. Each beam has on it a row of vertical fingers—slips of steel, covered with leather—set at regular intervals asunder, the upper fingers pointing down, and the lower ones up. The fabric is stretched horizontally between two rollers, over an intermittent traversing table, the fringe threads being held evenly by hooking the piece on two opposite rows of pins or tenter-hooks. Then, as the two twisting finger beams traverse, the corresponding fingers on the upper and lower beams rest against each other as they traverse into, and out of, contact, passing at the same time directly through, or between, the lines of fringe, and at right angles thereto. On the lower side of the platform is another traversing-beam, carrying a row of dividers or separators—thin plates of metal—each notched with a long and short vertical cut, and pointed at the upper end to enable it to penetrate easily between the fringe-threads. This beam is actuated by a pair of cams from below, so as to detach certain portions of fringe-threads from the line at certain determined times. When in action, the dividers—one for each opposed pair of fingers—come up beneath the fringe and penetrate through it, each divider carrying up the separate portions of threads to a short distance above the stretched line. Whilst the threads are so held, the corresponding pairs of fingers come into frictional contact, and squeeze between them the two detached portions, to which they thus give the first twist, as in the hand movement. When the engaging stroke of the fingers has been nearly completed, the dividers fall away, and allow the separated portions to come together—still between the fingers—and the back or disengaging stroke of the fingers then gives the back-twist, to entwine the two portions into one. This finishes the twisting action; but as there are a quantity of untwisted threads left between each neighbouring pair of fingers, the length of fringe under operation is gradually completed, by giving the platform an intermittent traverse to carry away the twisted and bring forward the untwisted portions. This is done by a simple escapement action, a counterweight being added to draw forward the platform and fringe along the lines of fingers, until the space between each of the latter has been traversed, so as to bring each thread under the twisting operation. This machine does its work with great regularity and neatness, and at a rate with which that of the manual system cannot for a moment be compared. Another portion of Mr. Aikman's improvements refers to a "breadthener," or apparatus for stretching woven fabrics in the direction of their width. It consists of a horizontal tubular shaft, turned and fitted with two bosses, the peripheries of which are turned at a considerable angle with their axial line: in other words, the bore of the bosses is oblique to their diametrical plane. Each boss has fitted loosely upon it a disc, or wheel, with spur-pins set on its periphery, to hold the selvages of the cloth; and the latter, being entered upon the discs on their narrow side, or where their peripheries are nearest to each other, is traversed along by the revolution of the discs, until disengaged at the expanding side. By this means the fabric is gradually stretched according to the amount of angularity of the discs. The axis of the discs remains stationary, together with the bosses, which are fitted with projections, entering longitudinal slots in the shaft. The hollow of the shaft contains a long right and left-threaded screw, by which the discs may be set to any width of cloth, each projection from the boss having a nut engaged with the screw spindle. The apparatus is cheap, simple, and effective, and may be used either along with the patentee's twisting machine, or in the ordinary process of drying and finishing.

ORNAMENTAL FABRICS ("ZEBRAS.")

JAMES MACNEE, *Glasgow.—Enrolled July* 20, 1852.

The "zebra" manufacture is peculiar, or nearly so, to the workshops of Glasgow. It is a fabric with a smooth pattern side, ornamented by a particular class of stripe, combined with other devices as filling up, and a rough or "flushed" reverse side—the flushing being occasioned by the Jacquard action in weaving the figure,—and is chiefly made for the foreign trade for the turbans and robes of the East, as well as dresses and certain kinds of shawls. Such fabrics have hitherto been produced by the troublesome and expensive processes of winding, warping, and dyeing the yarns, and finally producing the ornamented fabric by an intricate system of weaving in the Jacquard loom. Instead of following this complex routine, Mr. Macnee produces fabrics of a similar class by a process which, whilst it is much more economical, yet gives to the goods a more effective appearance than the zebras manufactured in the usual way. He proceeds by first weaving the cloth, from yarns either grey or white, but neither dyed nor printed, in an ordinary loom, or by any other simple weaving mechanism—merely arranging the harness, or the warp and weft threads, so that the goods may have one surface plain or twilled, as the case may be, and the reverse surface flushed, to resemble the common zebra cloth. The zebra is completed by afterwards printing the required ornamental figure on the plain side. By the adoption of this system of manufacture, these goods are produced with the same ease, or nearly so, as plain fabrics, whilst the manufacturing cost is very greatly reduced; and the colours being laid on the extertor of the fabric in a solid mass, are full, bright, and solid in appearance, the dulling effect of the interference of the warp and weft threads of different colours being totally avoided. Mr. Macnee's invention bears most importantly upon the zebra manufacture, for it introduces an improvement at both ends—economy of production and superiority of effect.

CUTTING AND SHAPING METAL.

JOHN FREARSON, *Birmingham.—Enrolled July* 10, 1852.

Mr. Frearson's invention relates to the manufacture of buttons, once the great staple of Birmingham manufacture, and also the eyelets or looped rings for heddles—both being produced from metal discs pressed into the required form. The material, in the form of sheets, laid together in several thicknesses, is fed into the cutting machine by a duplex arrangement of feed-rollers, which hold the sheets well stretched out beneath the cutting punches, arranged in a row, to cut a great many discs simultaneously. The feed movement is intermittent, to suit the punching action—the motion being obtained by a differentially-threaded worm, portions of the threads being at right angles with the axis. By this modification, whenever the right-angled thread comes round, it passes without actuating its worm-wheel, which drives the rollers, and the latter, therefore, remain stationary, until the regular screw thread comes into play.

The metal discs so punched, of various sizes, are then passed to the shaping or pressing machine, in which the peculiar feature is a system of feeding the blanks into the dies by atmospheric pressure. The discs are first placed in vertical receiving tubes, being made to rest upon a piston or ram; and as the latter rises, it presses the piles of discs against the lower side of an atmospheric feeder, traversing in a grooved slide above. The feeder is recessed to receive the upper disc of the pile, and a flexible tube connects it with an air-pump, actuated by a cam and lever. As each disc is thus brought up to the feeder, it is sucked in and carried away by the traverse of the feeder, to the die which gives the first shaping impression, when the admission of the air to the feeder releases the disc, for deposit on the die. This arrangement is used in duplicate in making buttons, for pressing the upper and under button plates. Both discs are shaped at once, and the apparatus is so contrived, that the two discs meet in the centre of the machine, being each deposited on a die for effecting their junction. The button is now pushed away into the mouth of a vertical tube, down which it falls into a receiver beneath. A peculiar arrangement of fingers is used for conveying the discs from one die to the other—the disc being held between the corresponding semicircular surfaces of a pair of slides, which are pressed together to hold the disc, by a pair of blade springs. When the disc is to be dropped out, the two slides are made to separate by a pair of levers, which act simultaneously in drawing back the two slides. Each die has a pair of fingers, and they are all fitted into one common sliding frame, so that they all traverse laterally at the same time, for bringing the disc from one die to the next.

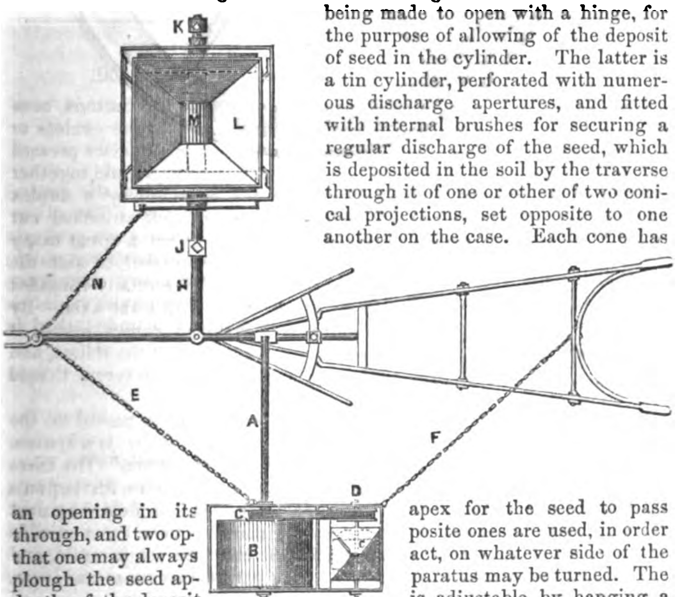
The patentee forms "eyelets" out of flat metal discs, which are first squeezed or "drawn" into a tubular form by a mandril and die, just as in M. Rémond's very beautiful process in making tubes. The closed tube end is then perforated, and the tube is afterwards squeezed into a shape resembling that of a sheave for blocks, or an externally grooved ring—this process being effected by passing the tube on to a revolving spindle, suitably grooved. As the spindle revolves, the plain tube is forced into the ring groove, by the pressure of a corresponding tool.

REGISTERED DESIGNS.

COMBINED DOUBLE-MOULD-BOARD PLOUGH, SEED-SOWER, AND MANURE-SOWING RUTTER.

Registered for MR. THOMAS REID, *Monkton-Miln, Ayrshire.*

This very complete and comprehensive implement, although got up out of very simple materials, and easily arranged, is capable of performing a great variety of work. Our illustrative figure shows the entire machine in plan, with the seed-sower, and manure-sowing box and rutters attached. Its foundation, or main portion, is a double-mould-board plough, which has jointed to it a transverse rod, A, to carry a seed-sower. The outer end of this rod answers as the axle of the broad wooden roller, B, running loose upon it over the ground, and having fast to one side a band-pulley, C, from which an endless band passes to a second pulley on the spindle, D, for actuating the seed-box cylinder, as shown in dotted lines—the whole being encircled by an open rectangular frame. This seed apparatus is stayed and retained in position by the front chain, E, attached to the frame, the other end being connected to the front end of the beam. A back chain, F, is also similarly fitted to the seed frame, having its other end fastened to a cross bar of the stilts; this is to enable the attendant to turn over the seed apparatus by the joint of the rod, A, to the other side of the plough, at the termination of each drill. The case, G, of the seed-box is of sheet-iron, and is attached to the rectangular frame surrounding it—one-half of the case being made to open with a hinge, for the purpose of allowing of the deposit of seed in the cylinder. The latter is a tin cylinder, perforated with numerous discharge apertures, and fitted with internal brushes for securing a regular discharge of the seed, which is deposited in the soil by the traverse through it of one or other of two conical projections, set opposite to one another on the case. Each cone has an opening in its apex for the seed to pass through, and two opposite ones are used, in order that one may always act, on whatever side of the plough the seed apparatus may be turned. The depth of the deposit is adjustable by hanging a weight to the back of the seed-box frame.



On the other side of the plough is a second transverse rod, H, jointed horizontally to the plough beam, and carrying a tracer, J, adjustable to any required width of drill, whilst at K is a rutter, to make an opening in the earth when manure is to be deposited. When the manure is sown by the machine, at the time the rut is made, it is placed in the rectangular box, L, carried by a light frame fastened to the rod, H. This box is supported on a pair of wheels, connected by a hollow spindle running loose on the rod, H, and having a fluted roller, M, thereon, working in the bottom of the manure-box. When so arranged, a pair of rutters, one at the back and the other at the front of the box, make the required opening for the manure. The manure-box frame has on one side a short rod, with a sliding staple attached to the end of the stay-chain, N, connected at its other end to the plough beam. In this way, the apparatus reverses itself at the termination of each drill, without further trouble on the part of the attendant.

PORTABLE STEAM FORGE.

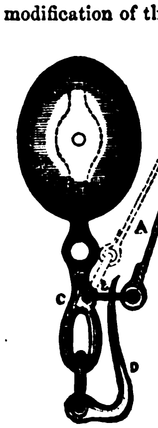
Registered for MR. G. CAMPBELL, *Chorlton, Woolwich.*

This novel forge embodies both a blowing and a striking apparatus, actuated by a small steam-engine, which obtains its steam partly from the forge fire. The framing which carries the forging hearth has attached to it, near one end, a small horizontal steam-cylinder, of about four inches diameter, working a crank on the main first-motion shaft. This shaft has upon it a spur-wheel, gearing with a pinion on a second shaft beneath, and carrying a fly-wheel. This fly-wheel answers as a large drum; and an endless band from it passes upwards to a third shaft overhead, on which is the blowing-fan, making forty revolutions for four of the engine, or about 1,600 per minute. The lower shaft, running at 200 revolutions, carries a drum for actuating any separate machinery. The boiler is placed over the hearth, and it is supplied with fuel from the top by a species of funnel, and both fires may have the fan-blast applied to them at pleasure. The forging anvil is placed by itself on the floor, at the other end of the machine, and the hammer is attached to a lever set on a horizontal shaft in the hearth-frame, and actuated by the steam-cylinder through a long sliding-rod, which strikes the tail of the lever. Hand gear is also provided for working the forge, either for getting up the steam at starting, or for working altogether without steam.

DISENGAGING APPARATUS FOR LOWERING BOATS AT SEA.

Registered for MR. J. J. BALL, *Master R.N., London.*

This is an extremely simple, but clever and useful, modification of the existing suspending apparatus of boats, the alteration being entirely in the tackle-blocks. The boat is suspended fore and aft, from a pair of davits, in the usual manner; but each tackle has, in addition, a secondary line, one end of which is attached to the upper block, whilst the other and lower end terminates in a ring, connected with a disengaging hook or catch, on the link of the block beneath.

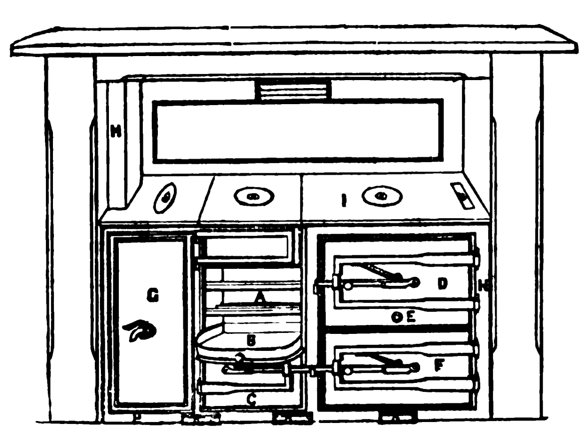


Our figure represents a side view of this lower block. The disengaging cord, A, has its ring, B, passed through, or entered into, a hole in the suspending link, C; and the point of the hooked detent, D, which carries the suspending link of the boat, is passed through this ring. The line, A, is set of such a length, that, as the boat is lowered down at each end, on an even keel, the ring, B, is drawn upwards to the position of the dotted lines, and the detent, D, being thus cleared from the rings, the boat drops gently and evenly into the water.

KITCHEN RANGE.

Registered for MESSRS. G. H. & G. NICOLL, *Ironmongers, Dundee.*

Compactness and economy of action are the essential points aimed at by Messrs. Nicoll in this design. Our engraving represents a perspective front elevation of the range.

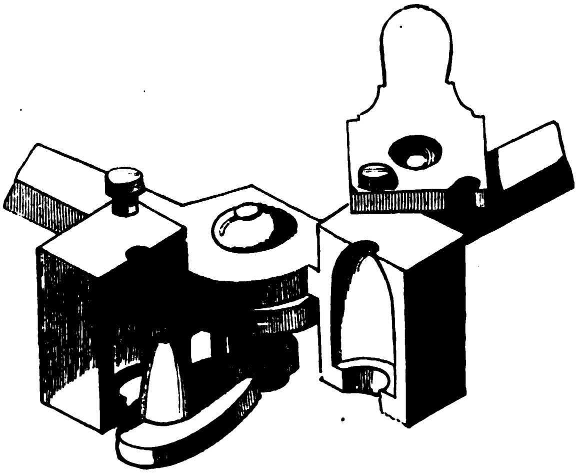


The fire-grate, A, is fitted underneath, with an ash-pan, B, below which is a heated chamber, C, to be used for warming dishes, or keeping cooked meats hot. The upper oven, D, which has a ventilator, E, may be used for baking meat, and the lower one, F, may be similarly employed for pastry. On the opposite side of the fire-place is a boiler, G, running behind the grate, for supplying hot water for baths and ordinary kitchen purposes. The ovens, heated chamber, and boiler, are heated by the several flues, H, running entirely round them, and serving as well to heat the plates, I, which are serviceable where slow boiling is required. The arrangement is neat, substantial, and apparently efficient.

MOULD FOR HOLLOW BALLS.

Registered for Mr. J. T. Campion, *Exeter.*

Mr. Campion attaches the conical core which moulds the hollow of the ball, upon the joint centre of the mould, in such a manner, that the opening action carries the core and the bullet with it, half way between the two cheeks of the mould. Thus, after casting, the bullet, being freed from the chamber in which it is cast, falls immediately from the core when the mould is reversed; and the core is re-adjusted by the mere action of closing.



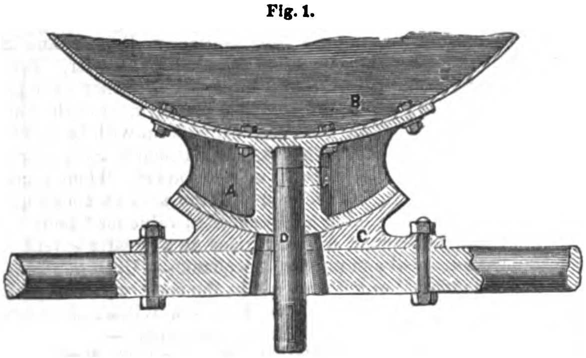
Our perspective figure represents the mould as open, with its handles broken away. Its details are obvious; and its advantages may be summed up as involving a saving of time, from requiring no adjustment of the core, the prevention of the accidental loss of the core by reason of its being in one piece with the mould, and great accuracy, from the absence of all friction on the core during casting, so that it does not work loose, or get out of the perpendicular.

SPHERICAL LOCKING CARRIAGE.

Registered for Messrs. Ransomes & Sims, *Engineers, Ipswich.*

Our figures illustrate the application of this contrivance to a "farmer's engine," but it is obviously suitable for various wheeled implements or

Fig. 1.



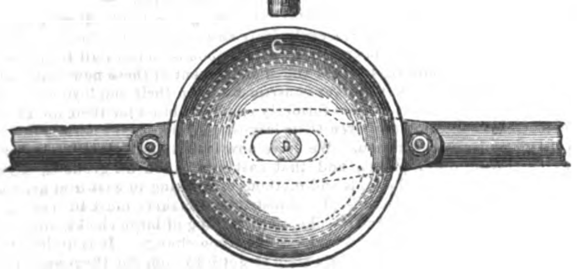
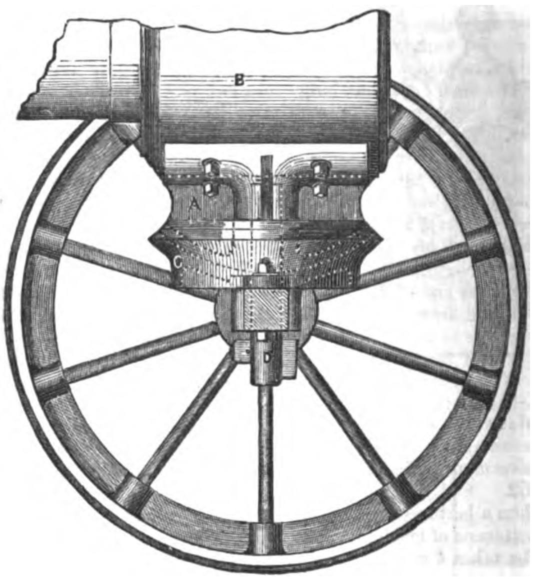


Fig. 2.

vehicles. Fig. 1 is a vertical section of the arrangement, showing the central portion of the axle, with the wheels broken away on each side, and fig. 2 is a plan of the concavity of the working surfaces. Fig. 3 is a side elevation of the parts, showing one of the wheels, corresponding to fig. 1. The underside, or bearing surface of the piece, A, secured to the engine smoke-box, B, is spherically convex, whilst the corresponding surface of the piece, C, bolted to the top of the axle, is concave to fit,

Fig. 3.

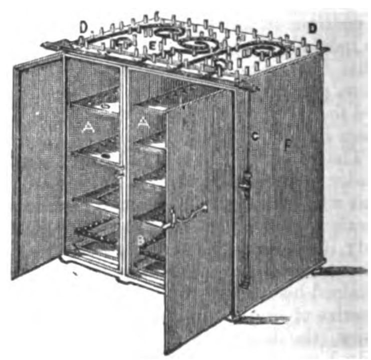


instead of having flat working surfaces of the usual kind, the central bolt, D, forming the link of connection between the two. The advantages of the plan are, that whilst the fore axle and wheels are perfectly free to turn horizontally, the axle itself is also free to move vertically; so that, should either of the fore wheels meet with any obstruction tending to alter the axle's horizontal position, the body of the vehicle is at once relieved from all cross strain, and is maintained undisturbed in its level position.

GAS-COOKING STOVE.

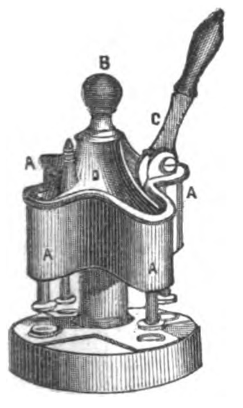
Registered for Mr. G. Bower, *St. Neots, Huntingdonshire.*

Our perspective figure represents Mr. Bower's design with both its doors open, to show the internal arrangements. It is a plain rectangular iron case, unequally divided into two main sections by a vertical diaphragm—these spaces being subdivided into the compartments, A, for holding the articles to be cooked. The gas-burners, B, are arranged near the bottom of each section, on tubes bent rectangularly to the shape of their respective spaces—the gas being supplied by the pipes, C, as well for these burners for cooking in the interior of the stove, as for the external coils for boiling. The flat top is studded with projections, D, as supports for the pans, or other boiling apparatus, the heat for which is obtained from burners, E, set in a series of tubular scrolls laid along the top. The external case, F, and the doors, are double, to afford a non-conducting air space all round. With the exception of the single point of the external tubular scroll arrangement, the stove does not present any material similarity to either of Mr. Graham's two designs. Our note of last month on this point, was written from insufficient particulars, and with the figure now given before us, we may safely withdraw our observation as to its being a "careful copy." At any rate, our readers have now the means of duly exercising their own judgment in the matter.



QUADRUPLE EMBOSSING PRESS.

Registered for MR. T. POPE, *Birmingham.*



Hitherto, the users of embossing presses, where more than one pair of dies are employed, have been subjected to great annoyance from the trouble and difficulty of changing and resetting. This objection is now removed by Mr. Pope's clever contrivance, combining several dies, or raising and piercing tools, in one apparatus. In the example which we have selected, four separate embossers, A, are fitted in one stand round a central axis, B, all being workable by the single lever, C. The embossers are stationary, but the head, D, is capable of revolution upon its centre, B, carrying with it the actuating lever, which may thus be easily brought over, and made to work any given embosser at pleasure. Of course, the number of embossers, or impressing actions, may be indefinitely multiplied.

REVIEWS OF NEW BOOKS.

ON MACHINES AND TOOLS FOR WORKING IN METAL, WOOD, AND OTHER MATERIALS. By the Reverend Robert Willis, M.A., F.R.S., &c., Jacksonian Professor in the University of Cambridge. Bogue, London, 1852.

When a barbarian has observed, for a sufficiently long time, the various instances of mechanical action which may obtrude themselves upon him, he takes a position infinitely above his former self, immediately he detects a certain principle constantly associated with any number of such instances. The common tools—the plane, the saw, the file—stand out as witnesses of the certainty of his observation, and form, in fact, imperishable records of its results. They are documents far more readily legible than the majority of such as have been permitted by our legislators to lie decomposing in mildew or damp among the archives of the nation, written in a very plain hand, and in a language intelligible to all. The only fact they do not teach, is the particular distant period when the scraping shell, or the sharp, or jagged, or rough flint was converted, by an act of man's naturally generalizing mind, into the neater instrument by which the special duty was, for ever, to be better performed. Fortunately, the inquiry into the antiquity of any matter is not of essential service to human affairs in general. It may amuse a leisure hour, it may satisfy the vain cravings after fame, it may do more, probably—it may be an instrument for exciting the imagination, and so far increase the quantity of working stuff in the world; but it can do no more. It does not come home to men's hearts and bosoms; their daily enjoyments are not, in any sensible degree, increased by it. The wooden and iron literature, of which we were lately speaking, as it thus records, so it points to better things, and creates art, and a taste for it—and science, and a taste for that also. The first rudely-formed tool is not destined to continue in an unprogressive shape for ever, although it may do so for an indefinite length of time; nor is human labour constantly to perform what the steam-engine has taught us may be accomplished as, or even more, perfectly, and with greater economy of time. The history of this, and the latest brilliant fact which it records, is well deserving a short space in our columns.

The clockmakers, to which body Hindley of York, the presumed inventor of the now universal screw-cutting machine, belonged, were the first who employed special machines for their manufacture. From the greater accuracy required in any mechanism aiming at chronometrical duty, it is not difficult to account for this. The clockmakers, in this, were almost as obsequiously followed by the lockmakers. Bramah, in 1784, obtained his well-known patent, and immediately set about constructing a series of original machine-tools, for shaping, with the required precision, the barrels, keys, and other parts of the contrivance, which, indeed, would have utterly failed, unless they had been formed with the accuracy that machinery alone can give. General Bentham made great progress in this. He followed the lockmakers, as these did the clockmakers. His specifications of 1791 and 1793 are remarkable, and tend to exemplify what we have recently, in another place, attempted to show, how advantageous a record of the history of progress exists in the enrolment of these documents, and in the means they furnish to enable us to arrive at satisfactory conclusions with regard to education in these matters. He it was who first informed the world how important it was to reject the common classification of works, according to the trades or handicrafts for which they are used; and it was he who first classed the several operations that have place in the working of materials of every description, according to the nature of the operations themselves. Thus did this truly able man theorise correctly; and the reader of mechanical history has not to be reminded how he proved the truth of his speculations, by mechanically performing as well the general operations of planing, rebating, mortising, sawing in curved, winding, and transverse directions, as by completing machines for preparing all the parts of a sash-window and of a carriage-wheel—machines which were exhibited in a working state, in 1794, in London. General Bentham was soon appointed Inspector-General of Naval Works, and such kind of machinery soon found its way into the great Government establishments. In 1802, Mr., afterwards Sir Isambard Brunel, submitted his plans of the block-machinery; and, his services being immediately secured, the admirable series of machine-tools, well known to visitors of Portsmouth dockyard, were constructed, and by means of which all parts of the block, and its sheaves, are prepared from the rough timber and bar-metal to the article ready for use.

But "the greatest boon to constructive mechanism, since the invention of the lathe," has been, according to Professor Willis, the now universally used and so-called planing-machine. This, as our readers are well aware, could not have been suggested by either Bentham's or Bramah's patents above alluded to; for the properties and arrangements are wholly different. It is strange that this machine, now indispensable to the engineer, made its way into the world silently and unnoticed. This seems, indeed, to be a rule with the best productions of all kinds; and then, when we want to know something of its origin, we have to grope our way into, perhaps, nothing but the labyrinth of human tradition, and are perplexed with many claimants of an honour due, in all probability, to one. "Somewhere"—even the Professor is obliged to write thus vaguely—"somewhere about 1820 or 1821, a machine of this kind was made by several engineers; but no drawing or description of it appears to have been made until 1833, when the Society of Arts published beautiful engravings of the particular machine made by one of those gentlemen." Mr. Willis, in noticing these circumstances, alludes to the greater interest the French people seem to have taken in these machine-tools, who, much earlier, began to give such essential aids to the student of this department of practical mechanics. In 1829, the *Industriel* has one of the simplest, and the bulletin of the "Société d'Encouragement," the collections of Le Blanc, Armengaud, and others, contain engravings, not only of the planing machines, but of the other machine-tools, of all our best English makers, generally accompanied by admirable descriptions and minute details, that have served as models to many that have appeared in our own pages, and, at the same time, show how much really good service is rendered by the superior mathematical and theoretical education of French engineers.

Mr. Willis goes on to remark upon the very interesting and suggestive collection of strange working-tools from Germany, France, and elsewhere, which was displayed on the great occasion of last year. Some of these, undoubtedly, have afforded useful hints. The author exemplifies in particular, and with justice, the universal employment of the narrow frame-saw on the continent, for work that we perform with broad-bladed saws, stiffened with brass or iron backs, and intimates an opinion that our practice in this respect is probably carried too far. There remains, nevertheless, says the author, too much of the ancient contempt for "theory," and of an overweening and conceited value for "facts" and "practice." In no department is this carried to a greater extent than between the mathematical and practical mechanics. Upon another subject, namely, the material of greatest use in the construction of philosophical instruments requiring steadiness, Professor Willis's observations are too important not to be quoted at large. He says:—

> "But the facilities for working in metal, and its general introduction into all kinds of framework, where wood was exclusively employed, as well as the substitution of cast-iron for brass, has made it imperative upon persons of all trades, which are affected by these changes, to learn the management of these new materials, if they desire to profit by the advantages consequent upon their employment. Thus the philosophical instrument-makers formerly employed brass for their metal-work, and constructed their machines, even their largest philosophical instruments, with a great number of pieces screwed. We have now learnt that stability is best insured by employing fewer pieces, and that cast-iron is, on all grounds, a better material than brass. But the tools and methods of working in cast-iron are wholly different; and therefore the philosophical instrument-makers must turn engineers, and employ planing machines and the like. The making of large clocks, and various other articles of common use, must undergo the same change. It is useless to say that these men can go to an engineer's shop to get jobs done for them as required. Such a method can only lead to a partial and imperfect employment of the resources and advantages which are to be developed. For, instead of a full and complete adoption of these novelties, the use of them will be necessarily evaded in every case where they can be dispensed with, unless the master workman can employ them freely as his own."

The Professor, continuing in this course of thought, emphatically concludes his discourse in the following words:—

"And I am persuaded that one of the most important and instructive lessons which the Great Exhibition brought before us, consisted in the display and contrast of the application of different materials and different methods to identical purposes, by the various nations of the universe. May we be enabled to read the lesson aright."

As a means towards this desirable end, he tells us that the first object is to effect a more intimate union, and greater confidence, between scientific and practical men, by teaching them reciprocally their wants and requirements, their methods and powers, so that the peculiar properties and advantages of each may be made to assist in the perfection of the other; and that the second object is, to promote a more universal knowledge amongst mechanics and artisans of the methods and tools employed in other trades than their own, as well as of those employed in other countries in their own and other trades.

We trust the attainment of these objects is not quite hopeless. "That most admirable and most unique incident of human history," as Mr. Willis calls the Exhibition, has enabled us to grasp at it. From the collection there, made up of natural materials, artificial products, and the processes by which the first are converted into the second, we have learnt enough to show that such attainment is in our power. The choice and display of the useful and ornamental results of industry, "for the first time offered, in one vast bazaar, by the whole world of manufacturers to the whole world of consumers," have not been, we are sure, fruitlessly exhibited in the land which brought them together; and, with the lecturer, we may hope that one of the "permanent results of the Exhibition may be, that men's minds, being more forcibly led to the consideration of the subject, a system of *professional education for practical men* may be organized, so as to enable every one to obtain just so much as may be necessary for him in his own position."

We cannot close these few remarks without adverting to the absolute necessity, for the young mechanic more especially, to give the few hours that it requires to a diligent study of the whole course of the important lectures which we have lately been reviewing. Those of our correspondents who have requested us to continue these papers, will, upon reflection, see that we appreciate too highly the privilege we enjoy of imparting the best information from the best sources, not to take advantage of a series of publications which may be hereafter looked upon as the foundation of a new edifice of British fame.

METEOROLOGICAL AND ASTRONOMICAL NOTICES FOR DECEMBER, 1851. By Professor C. Piazzi Smyth. Pp. 12. Neill & Co., Edinburgh. 1852.

This instalment of the results of the labours of the Scottish Astronomer-Royal—a reprint from the *Edinburgh New Philosophical Journal*—is devoted to the consideration of recent points of interest affecting the motions of the atmosphere, and the law of storms, including the doings of the gallant *Pekin* steamer in a Chinese typhoon; Saturn's new dark ring, discovered by Professor Bond; the new planet *Eunomia*, by M. Gasparis of Naples, and Mr. Lassel's prize of the new satellites of Uranus; and Mr. Sheepshanks' standard thermometers. Taking advantage of Lieut. Maury's investigations as to atmospheric movements, with a careful examination of all available ships' log-books, the Americans have stepped far beyond us in their practical knowledge of the law of storms. Lieut. Maury's "wind and current charts" are indeed invaluable, for he has inserted in them an arrangement of symbols, showing the strength and direction of both wind and current each day, as deduced from ships' logs; and thus the mariner, gaining by the accumulated experience of countless preceding voyages, is made aware of what winds have a chance of affecting him in future. The truth of this has indeed already been shown, for Professor Smyth tells us that—

"Of the arrivals at San Francisco, the quickest passages have been made by American vessels, and of these the six shortest have had the wind and current charts on board. The average length of passage of all the American vessels through the year is 183 days, while the average of the six shortest, who had the assistance of the truly scientific principle of profiting by the experience of all their predecessors, was only 114 days! Again, these charts have indicated a much shorter passage to the Line from the United States than vessels had been accustomed to follow from time immemorial; and logs had just been received of two vessels which had sailed at the same time, one a merchant vessel, and the other a man-of-war, and possessing, therefore, it is by courtesy to be supposed, superior sailing qualities; yet, by taking the old route, it had not reached the Line, when the other had not only passed it, but was even 1500 miles beyond!"

The currents of the sea are also being slowly elucidated, so that these dangerous sources of shipwreck have now some chance of being somewhat better understood than they are just now.

Finally, a set of "*whale* charts" have been prepared, to point the times and places where whales have been met with; and these, "whilst they promise to be of great service to that important branch of the American fisheries, seem to show that the whales have a great deal more knowledge than we have usually given them credit for, and know a great deal more about the warm and cold currents of the ocean waters than we do, or have done."

Crude and partially ungeneralized as these charts must yet be, they are eagerly sought after by American navigators, whose profitings thereby may perhaps induce our own seamen to avail themselves of their teachings, as well as to aid in the collection of materials for perfecting them. The vast amount of information to be gleaned from the innumerable log-books of our vessels—were they searched, noted, and compared, as are those of the United States—would add so enormously to the already important value of the American charts, that we are ourselves conscious of the performance of a more than ordinarily important duty, in urging this matter upon the attention of our readers, and, through them, upon those in office.

As a scientific man, Professor Smyth objects to our competing with the Americans in exactly the same course; but for our part, and regarding the matter less as an abstract scientific point than a contribution to a volume of world-wide value, we cannot see any "competition" in it. As a field for our research, he proposes the formation of "*hurricane* charts"—a subject of far narrower limits, but by no means deserving of the neglect which it has received at our hands. It is on this head that he cites the case of the *Pekin*, a Clyde-built iron vessel, whose gallant behaviour must have gladdened the hearts of Messrs. Tod & M'Gregor, her builders:—

"The vessel was on her voyage from Canton to the Straits, and was in lat. N. 16 deg. 45 min., long. E. 110 deg. 45 min.; the log-book describes the falling of the barometer, and the rising of the wind and sea, and their portentous increase; then there follow successive entries as the night comes on, of the various sails which are blown away one after the other, of the boats washed off, and of masts and ropes broken, and of the utter consternation of the crew, who hide themselves in their despair. At length the vessel is no longer able to make any progress against the mighty odds, and all the *quasi* vital force of her large steam-engines is employed merely to keep body and soul together; in keeping the vessel's head to the waves, and preventing her getting into the trough of the sea. It is confessed, that had not the vessel been a steamer; or, being a steamer, had it not been so admirably strong and taught in every way, it must have foundered with all on board; at length the direction of the wind changes, the barometer begins to rise, and by the morning the storm has passed.

"Now, it is doubtless extremely gratifying to hear, that British oak* can withstand great roughness of weather, but was there any necessity of exposing it to such a death-struggle as this? Not the slightest. The barometer falling showed the approach of the hurricane, the direction of the wind showed that the vessel was on the N.W. edge of the circle, and there was abundance of sea-room to sail away northwards, where but a small space would have carried the ship out of the storm's reach, and have allowed it to pass by. But instead of that, the vessel sailed away southwards 58 miles, that is, towards the centre and most dangerous part of the storm, until compelled, in spite of itself, to desist from so mad and headlong a career. Fortunately, the centre was not reached, or probably the account had never figured in the *Illustrated London News*: but the greatest danger was incurred, and actual losses experienced, to an extent that would have furnished all the British navy with wind charts. The change of the direction of the wind towards morning, its abatement in strength, and the rise of the barometer, showed that the storm then had passed away, and in the same path, and with the same characteristics, that all other Chinese typhoons have done before. This one was therefore nothing new, that a captain of so large a vessel should have been taken unawares by it. Moreover, those typhoons or hurricanes have been proved, by such a legion of melancholy catastrophes, to be far more than ships built by mortal hands can stand, when they get into the vortex (in one towards the end of the last century, in those same seas, 100,000 men are said to have perished), that no passenger merchantman, steamer, or sailing vessel, is justified in not getting out of its way, when there is plenty of sea-room. And if the steam company do not mulct their captain in the cost of all the sails, ropes, masts, and boats carried away, it is to be hoped that the underwriters will take up the case. At any rate, if so prominent an instance should induce some official recognition of the importance of making and enforcing the use of a series of hurricane charts, science will be the better for it, and the lives of those of our countrymen who have to voyage in tropical seas will be so much the safer."

We must pass over Professor Pierce's contributions to our information regarding Saturn's ring, and the other astronomical memoranda in our author's paper, to glance at Mr. Sheepshanks' standard thermometers. That gentleman has latterly given a good deal of attention to the construction of a standard scale of length, and has at last got over the difficulty, in the way of procuring sufficiently accurate thermometers to ascertain the temperature and the consequent expansion of the scale. His accuracy is such, that he can now depend on $\frac{1}{30}$th or even $\frac{1}{50}$th of a degree of Fahr., the columnar height of the mercury being read off by a telescope and micrometer.

"The bulbs are generally about $\frac{1}{2}$ to $\frac{3}{4}$ inch in diameter, and the tubes, which have the divisions etched on the glass, are in the longest cases 18 inches in length. These he calls generating thermometers; and as no thermometer is constant in wide ranges, and at *different* times, he has other thermometers, smaller, and with only

* The *Pekin* is an iron ship.—ED. P. M. JOURNAL.

a portion of the scale from freezing to boiling; and prefers to use a special instrument for a special temperature.

"The first practical difficulty is the equality of the bore of the tube: round bores are most even, but flat ones are easy to read off. In either case, care should be taken to pick out one with no *sudden* irregularities. To examine into the quantity of these, portions of the columns must be broken, and passed along the tube, first with one length of column, bisecting the extent of the scale, then trisecting, and so on, until every tenth or every fifth division has been tested. A little skill is required to continue to break off portions of the column without the application of a lamp to the bulb, as has previously been practised; and consists in dexterously reinverting the thermometer, which has just been turned downwards, and so bring the vacuum bubble, which will thereby have been formed in the bulb, to the neck of the tube. Exceeding pains are then taken, in determining the freezing and boiling points, that the pounded ice in the one case, and the boiling water in the other, are neither above nor below their natural temperatures; but even when this is accomplished, there arises the greater difficulty still, that heat seems to produce two sorts of expansions on bodies, viz., the ordinary, or that which ceases with the increase of temperature, and may be called the periodical expansion; and another, which may be called a secular expansion, much smaller in amount than the other, but continuing to exist days, or weeks, or months, according to the bulk of the article acted on. For strict purposes, therefore, to determine correctly temperatures below boiling, the thermometer should be boiled just previous to being used. But to avoid this trouble, Mr. Sheepshanks prefers, for noting ordinary climate temperatures, to have a thermometer marking only to about 70 deg. to 80 deg. Fahr., compared from time to time with one of the generating thermometers, and having its freezing point occasionally tested, — thus avoiding in any one instrument the application of any exceeding variations of temperature. This secular change probably affects the glass of the bulb more than the mercury contained therein, and is equally present in every metal, and indeed all substances, greatly to the confusion of our attempts to construct standard scales for exact scientific purposes. The *age* of the bar, and its former experiences, now seem to be elements in determining its length, in addition to the temperature at the moment.

"The old custom of making measuring-rods of wood was necessarily exploded before the advancing requirements for accuracy, when it was found that, in addition to expansion from heat, which could be measured, there was other expansion from moisture, which could not be measured accurately, and other alteration still from some sort of working or reaction of the late organic forces, which had vivified the wood, and made the tree, and are more difficult than ever to examine into, and seem to defy all our means of measuring their quantity and computing their effects,—while bone or ivory, anything, in fact, which has had life in it, is as little to be trusted as wood.

"Recourse was then had to metals, and men revelled in the fancied simplicity and certainty of the corrections to be applied to deduce the true length of a bar at any temperature. Bars of all metals, and in the state of metal, cast or wrought, hammered or rolled, round, flat, thick, thin, hollow, and solid, were all indifferently used: the thermotic expansion being ascertained in each case, by trying the length first in a freezing mixture, then in boiling water, and taking 1-180th of the difference so found, as the correction due to 1° Fahr.

"But now it is found, by close microscopic measurements, that according to the degree to which the particles of the bar were distressed in the metallurgic operations of rolling, hammering, &c., so will it have a greater tendency to return, though slowly and through long intervals, to some former shape. And as we cannot ascertain all the blows and severe trials which the bar may have undergone in its process of formation, or probably correct for them, if we did, for the effects will vary with every different metal and every variety of each metal, we can only eschew all recently manufactured bars, and prefer cast to wrought metal.

"Next it has been ascertained that no metal expands uniformly with the mercurial thermometer, and therefore the making the correction equal to so many 1-180th parts of the whole expansion, as the thermometer should be above 32° Fahr., is by no means true for points between 32° and 212°.

"And lastly, if the bar be heated up to 212°, it will be found not to come down again at once on cooling to its former length at 32°. As, therefore, so high a temperature is unnecessary, because we never have to use the rods, or to make measurements with them in an atmosphere of that temperature, the once favourite plan of boiling or roasting bars, so as to get their expansion indicated to a great extent, is now given up; and the better method is adopted of leaving the bars altogether to themselves and to nature. They are allowed to take any temperature that they please under the usual changes of climate; their lengths are carefully watched under all those slightly varying alterations of natural heat; observations are greatly multiplied; and equations of condition at last bring out the true law of expansion."

We wish we had more men, who, with Professor Smyth's official advantages, possessed his energy and care; for he always writes clearly, and goes to the pith of his subject.

THE STEAM-ENGINE, STEAM NAVIGATION, ROADS, AND RAILWAYS. By Dyonisius Lardner, D.C.L. Eighth Edition, pp. 422. Woodcuts. London: Taylor, Walton, and Maberly. 1851.

This volume is both a historical guide and a modern remembrancer; it is at once a storehouse of mechanical antiquities, and a text-book for the engine-builder of 1852; a tome learned in legendary lore, and a magazine of latter-day discovery.

"The history of the steam-engine," remarks the author in his opening paragraph, "offers to our notice a series of contrivances, which, for exquisite and refined ingenuity, stand without any parallel in the annals of mechanical science." How well he has acquitted himself in his treatment of such rich materials, is well attested in his seven preceding editions; and in this eighth *résumé* of his subject, he has added to the value of his work by cutting out a quantity of dry historical and biographical matter, and obsolete engine details, to make room for information of a more practical nature, and a "Review of the Progress of Steam Navigation."

The origin of this history is due to the Royal Dublin Society, for it was in the theatre of that Institution, some twenty years ago, that Dr. Lardner, at the Society's request, gave the popular series of lectures which formed the nucleus of the volume before us. Popular as lectures, they well deserved the gold medal which they won at that day; but their success in their more enduring form, and under an ordeal of infinitely greater severity, may well be regarded as a triumph seldom attained through such a channel. The present edition is divided into three parts, respectively treating, as in the words of the title-page, of the "Steam-Engine," "Steam Navigation," and "Roads and Railways." The first of these sections must be as well known to our readers as to us, so that we may safely pass to the second, where we find the following passage on the fact of the inventors of steam navigation being uneducated:—

"If the spirits of Watt, Trevithick, and Fulton, can look down on the things of this nether world, and behold the grand results their discoveries and inventions have produced, what triumph must be theirs! For half a century the steam-engine had remained a barren fact in the archives of science, when the self-taught genius of the Glasgow mechanic breathed into it the spirit of vitality, and conferred upon it energies by which it revived the drooping commerce of his country, and when the auspicious epoch of general peace arrived, diffused its beneficial influence to the very skirts of civilization. Scarcely had the fruit of the labour of Watt ripened, and this great mover been adopted as the principal power in the arts and manufactures, than its uses received that prodigious extension which resulted from its acquiring the LOCOMOTIVE character. As it had previously displaced animal power in the MILL, and usurped its nomenclature, so it now menaced its displacement on the ROAD. A few years more witnessed perhaps the greatest and most important of all the manifold agencies of steam—that by which it has given wings to the ship, and bade it laugh to scorn the opposing elements, transporting it in triumph over the expanse of the trackless ocean, regardless of wind or current, and conferring upon locomotion over the deep a regularity, certainty, and precision, surpassed by nothing save the movement of chronometers, or the course of the heavenly bodies. Such are the vast results which have sprung from the intelligence of men, none of whom shared those privileges of mental culture enjoyed by the favoured sons of wealth; none of whom grew up within the walls of schools or colleges, drawing inspiration from the fountains of ancient learning; none of whom were spurred on by those irresistible incentives to genius, arising from the competition of ardent and youthful minds, and from the prospect of scholastic honours and professional advancement. Sustained by that innate consciousness of power, stimulated by that irrepressible force of will, so eminently characteristic of, and inseparable from minds of the first order, they, in their humble and obscure positions, persevered against adverse and embarrassing circumstances, impelled by the faith that was in them, against the doubts, the opposition, and, not unfrequently, the ridicule of an incredulous world, until, at length, by time and patience, truth was triumphant, and mankind now gathers the rich harvest sown by these illustrious labourers."

The author expresses himself strongly on the advantages of "auxiliary power for general mercantile purposes, placing steam navigation in such a relation to "the new art of transport" on land, that whilst fast-going full-powered vessels carry on the mail traffic, the auxiliary ones may effect the purpose of the luggage trains.

The last section of the volume is necessarily superficial. Too little space is allowed for a great subject. Still, what is said at this part will be read with that interest which universally attaches to the writings of such a clear and well-practised author as Dr. Lardner. The volume is illustrated by Adlard's engraving from Chantrey's well-known statue of Watt, and a profuse sprinkling of woodcuts, many of them highly picturesque, by Jackson. A quotation from an eloquent page on the results of the employment of steam power, may not inaptly close our notice of the volume:—

"If the contrivances by which this vast power is brought to bear on the arts and manufactures be rendered attractive by their great mechanical beauty, how much more imposing will the subject become, when the effects which the steam-engine has produced upon the well-being of the human race are considered! It has penetrated the crust of the earth, and drawn from beneath it boundless treasures of mineral wealth, which, without its aid, would have been rendered inaccessible; it has drawn up, in measureless quantity, the fuel on which its own life and activity depend; it has relieved men from many of their most slavish toils, and reduced their labour in a great degree to light and easy superintendence. To enumerate the benefits it has conferred, would be to count almost every comfort and every luxury of life. It has increased the sum of human happiness, not only by calling new pleasures into existence, but by so cheapening former enjoyments as to render them attainable by those who before could never have hoped to share them: the surface of the land and the face of the waters are traversed with equal facility by its power; and by thus stimulating and facilitating the intercourse of nation with nation, and the commerce of people with people, it has knit together remote countries by bonds of amity not likely to be broken. Streams of knowledge and information are kept flowing between distant centres of population; those more advanced diffusing civilization and improvement among those that are more backward. The press itself, to which mankind owes in so large a degree the rapidity of their improvement in modern times, has had its power and influence increased in a manifold ratio by its union with the steam-engine. It is thus that literature is cheapened, and, by being cheapened, diffused; it is thus that reason has taken the

place of force, and the pen has superseded the sword; it is thus that war has almost ceased upon the earth, and that the differences which inevitably arise between people and people are, for the most part, adjusted by peaceful negotiation.

"Deep as the interest must be with which the steam-engine will be regarded in every civilised country, it presents peculiar claims upon the attention of the people of Great Britain. Its invention and progressive improvement are the work of our own time and our own country; it has been produced and matured within the last century, and is the almost exclusive offspring of British genius, fostered and sustained by British enterprise and British capital."

A Text-Book of Geometrical Drawing, for the Use of Mechanics and Schools, &c. By Wm. Minifie, Architect. Pp. 127. Plates. Third Edition. W. Minifie & Co. Baltimore, 1851.

The unquoted remainder of the elaborate title of this volume tells us, that in it "the definitions and rules of geometry are familiarly explained, the practical problems are arranged from the most simple to the more complex, and in their description, technicalities are avoided as much as possible; with illustrations for drawing plans, sections, and elevations of buildings and machinery: an introduction to isometrical drawing, and an essay on linear perspective and shadows: the whole illustrated with 56 steel plates, containing over 200 diagrams." Here is a tempting bill of fare for the young student; and we can answer for it, that the courses actually served up are fully equal to the author's character of them. He has had many years' practice as a teacher of drawing, and, like many of his brethren, has been at a loss for a safe practical text-book for his disciples, remarking, truly enough, that geometrical works usually contain too much theory, and too little practice; whilst works on architecture and machinery are voluminous, costly, and overladen with unimportant matter. Under these circumstances, he "collected most of the useful practical problems in geometry from a variety of sources, simplified them, and drew them on cards for the use of the classes, arranging them from the most easy to the more difficult, thus leading the students gradually forward; this was followed by the drawing of plans, sections, elevations, and details of buildings and machinery; then followed isometrical drawing; and the course was closed by the study of linear perspective and shadows: the whole being illustrated by a series of short lectures to the private classes."

The general features of this course have been adhered to in the production of the present work—the aim of which may be, to a certain extent, comprehended by attending to what is laid down in another portion of its prefatory remarks:—

"The definitions and explanations have been given in as plain and simple language as the subject will admit of; many persons will no doubt think them too simple. Had the book been intended for the use of persons versed in geometry, very many of the explanations might have been dispensed with, but it is intended chiefly to be used as a *first book in geometrical drawing*, by persons who have not had the benefit of a mathematical education, and who, in a majority of cases, have not the time or inclination to study any complex matter, or, what is the same thing, that which may appear so to them. But it is also intended to be used for *self-instruction;* and with a view of adapting the book to this class of students, the illustrations of each branch treated of, have been made progressive, commencing with the plainest diagrams; and even in the more advanced, the object has been to instil principles rather than to produce effect, as those once obtained, the student can either design for himself, or copy from any subject at hand. It is hoped that this arrangement will induce many to study drawing who would not otherwise have attempted it, and thereby render themselves much more capable of conducting any business; for it has been truly said by an eminent writer on architecture, 'that one workman is superior to another (other circumstances being the same) directly in proportion to his knowledge of drawing, and those who are ignorant of it must in many respects be subservient to others who have obtained that knowledge.'"

It is a pleasant task to the reviewer to give praise to a good book; and in giving an opinion on Mr. Minifie's production, we may do so by saying to those practical men who desire to gain some insight in the rules of geometrical drawing, that they may do so here, without wading through a mass of theoretical profundity, such as usually encumbers them on the threshold of the majority of treatises of this nature.

Whatever is said is rendered perfectly intelligible by remarkably well-executed diagrams on steel, the number of which—56 plates—leaves nothing for mere vague supposition; and the addition of an introduction to isometrical drawing, linear perspective, and the projection of shadows, winding up with a useful index of technical terms, forms a volume which is perhaps unequalled by any British work of a similar character.

An Improved System of Working Railways, whereby the Assimilation of the Broad and Narrow Guages may be Effected. By B. Smith, Esq. Pp. 16. Carnarvon: Humphreys.

A Railway Commission, appointed by government some years ago, reported that the broad-guage possessed many important advantages, when compared with its narrow competitor; but, seeing the much greater extent of narrow-guage lines, and the amount of capital necessary to adapt them to the broad-guage, they felt constrained to recommend the narrow as the national guage. As yet, we have no national guage. The broad and the narrow are still in competition, each with their defects and *both* producing the greatest—namely, break of guage.

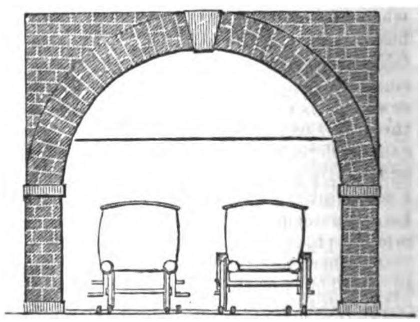
It is now upwards of fifteen months since Mr. Benjamin Smith laid before the public a system calculated to do away with the several defects of the two guages, as well as any arguments against the adoption of a national uniform guage.

Mr. Smith proposed to adopt broad-guage wheels with narrow-guage carriage bodies. The simple enunciation of this—though in it consists the whole of Mr. Smith's plan—is not sufficient to give a just idea of the great advantages it offers.

The substitution of narrow for broad-bodied carriages on the broad-guage lines, would be productive of a great saving in engine power. It is true, to have the same carrying space, the trains would require to be longer; but experiments have proved that increased length does not add anything near as much to atmospheric resistance as increased breadth. Another point of advantage would be the greater steadiness of the carriages, from the greater width of base, in proportion to the superstructure, in consequence of which, the limit of a safe speed would be very much extended. It would be a very great improvement on the narrow-guage carriages; for, with the same bodies, the base being much wider, they would be infinitely safer. Another advantage Mr. Smith's carriages will have over the present narrow-guage ones, is in the size of the wheels, as being safer, and involving less friction, than those at present in use.

With regard to the question of the expense of altering the narrow-guage lines to the wide guage, the author shows that not a single tunnel, cutting, or bridge, will require to be enlarged—not a single embankment to be widened, nor a single station platform to be moved further from the line; for the wide-guage wheels proposed by Mr. Smith will not project further than the footboards of the present narrow-guage carriages, and their footboards will be between the wheels. Mr. Smith proposes to lay down rails on the narrow-guage lines, outside the present rails; but not to remove the narrow-guage rails until the narrow-guage rolling stock at present existing is all worn out. Broad-guage carriages are to be constructed whenever new ones are required; but the old ones are to be kept running as long as they will last. He contends that a train, composed of part broad and part narrow-guage wheeled carriages, would be no inconvenience; for the centres between the two sets of rails will coincide, as also the carriage bodies, with their buffers and connections.

He also argues that two sets of rails would not be productive of much greater expense in the long run; for as long as the narrow-guage carriages last, the wear would be divided between them, and enable each to last so much longer. The broad-guage rails may be laid on longitudinal sleepers; or if cross sleepers are preferred, they may be easily introduced between the present sleepers of the narrow-guage rails.



Our engraving illustrates Mr. Smith's plan. It is drawn on a scale of 16 feet to 1 inch. The arch represents the lowest of the tunnels on the London and North-Western Railway; and the horizontal line above the carriages, shows the height of the lowest bridge between London and Holyhead. A narrow-guage wheeled carriage is shown at one side, and a broad-guage one on the other.

The Cottage Homes of England; or, Suggested Designs and Estimated Cost of Improved Cottage Erections. By J. W. Stevenson. Pp. 52. Plates. Houlston & Stoneman. London, 1852.

The dedication of this smoothly-titled book, "to the lovers of social reform, and especially the friends of the labouring population, and to all who desire to elevate the position of the working man by promoting the building of improved dwellings, and thus giving to him a better and happier home," bespeaks our respect for the author's intentions, in whatever light we might be inclined to view his works. The house a man lives in has a much greater effect upon its inhabitant, than is usually conceded to it. For, in addition to its size, substantiality, drainage, light, ventilation, local position, and cleanliness, as affects physical health,—its

intrinsic pretensions to elegance in form or arrangement and cheerfulness, or the reverse, must, in some sort, bear upon mental character. We do not mean to say, that a naturally dull, morose, or stupid man, could imbibe much cheerfulness or serenity from his house under any circumstances; but we do believe that he would have a much better chance of becoming a pleasurable mortal in a dwelling where he possessed the elegancies of refinement, even in the simplest matters, than within four mere dismal walls.

After a spirited appeal to landlords, and the "nobles and magnates of the land," on the subject of their share in promoting the comfort of the cottager, our author proceeds to the business of his book, by giving his views on—the site, aspect and position, extent of land required, style of building, arrangement and size of rooms, decorations and cost; all which he illustrates in a series of fairly-executed elevations and plans, and corresponding specifications. Considerable tact and ingenuity is evinced in many of the designs, considered, as they must be, in reference to their generally low cost. The book is altogether neatly got up, but is sadly disfigured by an absurd frontispiece—a perspective view of a double cottage—in which the drawing and engraving are equally wretched. But this has little to do with the practical value of the author's ideas; and all who are interested in buildings of the cottage class, may find a desirable guide in a "plea for the better construction of cottage erections."

The Advantages of Tubular Drainage as compared with Brick Sewers, &c. By John Thomson, C.E. Pp. 36. Glasgow: Smith & Son. 1852.

Some short time back there appeared in the public journals, a "Report by Architects of Glasgow, Members of the Architectural Institute of Scotland, on the Sanitary Improvements of Glasgow." That report characterizes the state of the drainage in this city as "alarmingly defective." The architects propose several means of improving the drainage, such as the construction of a weir in the river, so as to provide water for flushing the main sewers, together with a system of tanks and reservoirs, and apparatus for ventilating the sewers.

Mr. Thomson thinks these means are proposed from a want of acquaintance with the advantages of tubular drainage. He brings a large array of testimony in favour of the tubular drainage, and a deal of matter, chiefly derived from evidence given before the General Board of Health.

It is generally supposed that, when a sewer is in a bad state, it is not large enough; the contrary, however, is often the case. The bad state of a sewer is almost always caused by the accumulation of silt and sediment deposited by the water in passing, and this deposition is owing to the sluggish rate at which the water travels, as no sediment is deposited when the water runs at a sufficient speed. The less the area the water has to travel through in a given time, and with the same pressure or fall, the greater the speed; consequently, sewers ought to be made as small as the quantity of water they are to carry off will allow. If the sewers are of such a size that there is always a rapid current through them, no flushing or ventilation will be required, because no sediment can be deposited, and at the same time the force of the water will be sufficiently great to carry along with it sand, gravel, and even stones of a comparatively large size. Of course the entrance of the sewer must be so guarded, that nothing which cannot pass may be allowed to get into the pipes.

Another important point is, to have the inside of the pipes as smooth as possible, and the pipes free from any sharp turns, since nothing reduces the speed of water so much as friction, and the choking occasioned by acute bends.

The Glasgow architects also proposed to arch over the Molendinar and Barrowfield Burns, making common sewers of them—a plan condemned with great reason by the Board of Health in the following words, according to Mr. Thomson:—"One common mistake, leading to excessive expense and inefficient work, in laying out the drainage of a town, is to arch over some natural stream or watercourse as a main or outlet sewer, and this frequently costs as many pounds per year as the pipe-sewer necessary for the drainage of the house would cost shillings."

We are glad to see Mr. Thomson going the right way to work in this matter, and we hope his pamphlet may open the eyes of many who are no doubt ready enough to launch out into great and expensive works, but who yet require to learn that the end in view may be attained more certainly, more effectually, and at a far less cost, by a little attention to plain principles, easy to be understood. There are other reasons why more attention should be given to this subject. The rapid increase in the population of our large cities demands that every thing should be done that can be done in the way of sanitary improvements, amongst which none is so important as efficient drainage.

Jordantype, otherwise called Electrotype: Its Early History, being a Vindication of the Claims of C. J. Jordan, as the Inventor of Electro-Metallurgy. By H. Dircks. London, 1852.

This twenty-four page pamphlet has been called into existence by the lately revived claim of Mr. Spencer of Liverpool, to the great honour unquestionably connected with the discovery of the electrotype process. This claim, now revived after seven or eight years' silence, appears to be pretty fairly met by Mr. Dircks, who shows Mr. Jordan's position in a very clear light.

It was undoubtedly Mr. Jordan who, in a communication to one of our older contemporaries in May, 1839, first gave to the world an account of the very beautiful process, which, as he anticipated, has since become so important in the arts. It was not until the September following that Mr. Spencer made his appearance in the same field, by reading a description of a similar process, before the Liverpool Polytechnic Society; and, whether or not he was acquainted with the previous labours of Mr. Jordan, a comparison of the two papers certainly discloses a very close resemblance between them. Mr. Spencer rests his claim mainly on the fact of having given to the secretary of the Polytechnic Society, as early as May, 1839, a vague notice that he was making experiments with the galvanic battery, tending to the discovery of a new process, and the results of which he proposed to bring before the Society in due season. He was induced to give this preliminary notice from hearing reports that the Russian philosopher, Jacobi, had made some discovery not unlikely to prove of a kindred nature. This is a very slight basis for an important claim like this, and by no means so satisfactory as the actually detailed statement furnished by Mr. Jordan, which really ought to set the matter at rest, and put a stop to the necessity of our executing the very disagreeable task of giving judgment on contradictory evidence. Whilst we have this case before us, we may draw attention to the unmeaning custom of naming stars, flowers, minerals, and mechanical combinations, after their discoverers or inventors, instead of selecting names that point at once to the essential peculiarity, or aid in the classification of the object. Certainly, if an exception to our rule is to be made, it is in cases like this that it ought to be; for, where disputes of this nature arise, the true inventor is in some measure repaid for his previous vexation by the intimate linking of his name with the discovery that has cost him so much. Besides, it tends to remove the chance of further question, and enables the world to accord honour where honour is due. No person seems to be more worthy of such honour than Mr. Jordan, and no invention can give a better title to it than that of "Jordantype."

Hydraulic Tables, to aid the Calculation of Water and Mill Power, Water Supply and Drainage of Towns, and Improvement of Navigable Rivers, together with the Properties and Strength of Materials, &c. By Nathaniel Beardmore. 2d Edition. Pp. 207. Plates. London: Waterlow & Sons. 1852.

This is a very excellent volume, by an engineer, whose eminence in hydraulic matters well entitles him to guide us in his writings. In so diffuse a work, comprehending, as it does, so great a variety of questions in engineering practice, the reviewer must be content with giving his opinion, without attempting either citations to back it, or even an outline of its general matter. In addition to his "Hydraulic Tables," which appear to meet almost every possible emergency of the engineer who has to deal with water, including the tidal effects in all our principal rivers, and the flow and friction of water under various circumstances, he gives others relating to steam-engines, the weight of pipes, subsoil drains, strength and gravity of materials, suspension bridges, roads, and lock-gates, cast-iron beams, marine surveying, with the usual mathematical tables for reference.

Much of the matter is the fruit of the author's own experience; but the general mass, as a matter of course, is compiled from authoritative sources. This compilation appears to have been carefully and judiciously done; and in this he has accomplished all that the author of such a text-book could do.

A Plain and Popular Explanation of the Pendulum Experiment. By Bertram Mitford. Pp. 24. Woodcuts. London: Simpkin, Marshall, & Co. 1852.

The title selected by Mr. Mitford explains his views of the manner in which the notable "pendulum experiment" ought to be treated, to ensure its being comprehended by general readers. Accordingly, he considers it in a purely mechanical point of view, and he certainly succeeds in making the matter very clear. On a subject which has been so often discussed, we have naturally little left to say, except, indeed, to recommend those who are yet barely master of the question, to make the acquaintance of our old correspondent's book.

THE DICTIONARY OF DOMESTIC MEDICINE AND HOUSEHOLD SURGERY. By Spencer Thomson, M.D. Part I. Pp. 48. Groombridge & Sons. London, 1852.

Dr. Spencer Thomson does not here make his first appearance as an author; for he has written well on other subjects, more or less connected with his profession; but, as far as we can gather from "The Dictionary of Medicine," Part I., he has done nothing more to the purpose than this, his last undertaking. Hedged in by the jealousies and fears of its disciples, the medical profession is not often treated upon, in our times, in anything approaching to a popular manner; and feeling the full weight of this, the author touches upon it in his prefatory address, where he says—

"That works professing to afford popular information on medical subjects may thoroughly answer the purpose for which they are designed, one especial point requires ever to be kept in view—the information given must be safely usable by those who are put in possession of it. It is an objection frequently adduced against such works, that they place a little dangerous knowledge in the hands of the public, in a form so apparently simple, as to make it a source rather of evil than of benefit; and, undoubtedly, the allegation has in some respects been correct. But is it necessary, in preparing a work on domestic health, to incur this hazard? I think not. For without entering upon that difficult ground, which correct professional knowledge and educated judgment can alone permit to be safely trodden, there is a wide and extensive field for exertion and for usefulness open to the unprofessional, in the kindly offices of a *true* Domestic Medicine; the timely help and solace of a simple Household Surgery; or better still, in the watchful care, more generally known as 'Sanitary Precaution,' which tends rather to preserve health than to cure disease. 'The touch of a gentle hand' will not be less gentle, because guided by knowledge, nor will the *safe* domestic remedies be less anxiously or carefully administered."

Without descending into the misty depths of his subject, Dr. Thomson gives plain advice, as far as it may be followed without the immediate superintendence of a medical man. What he says is well illustrated by numerous woodcuts, and the alphabetical arrangement of his matter promotes accessibility to any specific information.

THE LOSS OF THE 'ORION,' THE 'AMAZON,' AND THE 'BIRKENHEAD:' A Letter to the President of the Board of Trade on the Management of Ships' Boats. By William Stirling Lacon, Esq. 2d Edition, pp. 64. Woodcuts. London: Parker, Furnivall, & Parker. 1852.

We have already drawn attention to the earlier edition of this pamphlet,* which has now gathered additional serious interest from the unfortunate affair of the 'Birkenhead,' whose sad loss has occurred in the interval of the two editions.

In applying his suggestions to the three lamentable cases mentioned in the title, the author directs special attention to—

1. *The lowering of the boats.*
2. *The stowing of the boats.*
3. *The covering of the boats.*
4. *The duty of the mate and others having charge of the boats.*
5. *The superintendence of the boats.*

And in his analysis of the evidence, he makes an energetic and well-directed appeal on the subject of the plainly apparent want of system and management which the evidence discloses. Such fearful losses, and coming so fast upon each other, ought to impress us with something more than mere ephemeral anxiety; more especially when followed up by a writer so earnest and painstaking as Mr. Lacon.

REPORTS OF THE EXHIBITION JURIES.—PRINTED FOR THE ROYAL COMMISSION. 1852. Pp. 987.

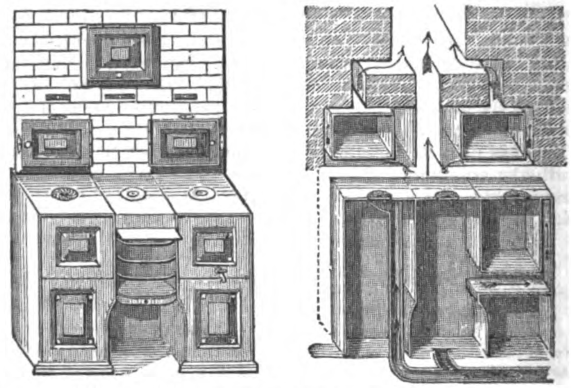
Just upon going to press, we have received a copy of these reports. Their voluminous character obviously prevents us noticing them in the present number. We are gratified to find that a circular has been issued to the various local committees, intimating the intention of the royal commissioners to present a copy of the reports, accompanied by a medal, to each of the exhibitors, in such a manner as the local committee shall consider will be the most gratifying to the recipients. This distribution will take place during the present month. The work before us promises, from its mere appearance, with regard to the arrangement of the contents, to be quite a historical document, and is got up in the very best style.

* Page 12, Vol. V., *Practical Mechanic's Journal.*

CORRESPONDENCE.

GRIFFIN'S COTTAGER'S STOVE.

If there should appear to be sufficient merit in the arrangement of this stove, to warrant your placing it in the pages of the *Practical Mechanics' Journal*, it may, perhaps, by this means, at least afford some hints for the construction of this class of domestic apparatus. My sketches respectively represent an external elevation, and a corresponding vertical section of the stove, fitted with two ovens, or an oven and a hot closet.



One oven would be sufficient for cottage purposes. It comprises an open fireplace in the centre, a draw-shelf at the bottom of the grate, a drop-shelf at the top, which, when raised, forms a blower, a hot plate forming an ironing stove, an opening at the top for the emission of warm air, an oven, hot closet, damper, and sweep door, and a boiler. In the flange of the oven and closet are slide doors, for the purpose of admitting a brush when sweeping is required.

The specimen which I have put up for my own use fully answers my expectations, and has made what was my coldest apartment by far the warmest. As the oven is principally heated by hot air, or carried heat, whilst it has a flue all round it, it heats on all sides alike, and without scorching or burning, and the heat being confined by dampers, it requires less fuel for cooking than the common range.

When cooking is over, a fire made up of small coal, cinders, and ashes, well saturated with water, will last for several hours. The room is made agreeably warm by a continual supply of pure, warm air, drawn in from without, through a drain or pipe, to the hot air-chambers at the back and side of the fireplace, and emitted at the aperture at the top of the stove.

Lastly, it affords a certain cure for smoky chimneys. It has recently occurred to me, that it might be contrived to emit warm air and aqueous vapour at the same time, and through the same opening. This would be very useful; indeed, it is just what is wanted for small conservatories. I believe the principle to be right, and hope it will be the means of adding to our cottage comforts.

WM. GRIFFIN.

Eydon, Daventry, July, 1852.

MINE VENTILATION BY THE FAN-BLAST.

The prevalence of explosions in coal mines, arising from the accumulation of foul air, from a defective system of ventilation, seems to call for something else, either to aid or supersede the present plan of ventilation, by means of an upcast shaft, as a slight fall of the roof or other casualty speedily stops the feeble circulation in the mine, and allows of the accumulation of gas, which might be remedied if the circulation were aided.

To remedy this, I beg to suggest the propriety of placing, at the bottom of the upcast shaft, a fan-blast, to take the foul air as it comes from the workings, and blow it up a tube in the upcast shaft. It would thus increase the speed of the current of air, and render it less liable to be interrupted by any fall of roof which might take place; and, even in the event of a fall taking place, it would (if it did not entirely block up the air-courses) still maintain, at least, a tardy circulation. The decrease in the quantity of air given off by the fan in such a case, might at once be seen by having a tube (upright) in connection with the air from the fan, and in the tube a piston of cork or wood, with a wire attached to it, the end of the wire to be attached to an index, so that any variation in the pressure of air given off by the blast might be seen on it by its

rising or falling, and lead to an investigation of the cause of the interruption, and be the means of saving human life. The fan might be worked by steam or other power: it might be made large, and would not require to run so fast as if it were small. The individual in charge of the engine would have to attend to the index, and report any sudden change which might take place.

Should you think this worthy of a place in your valuable journal, I will be obliged by your inserting it, in hopes that it may meet the eye of some of your readers, who may think it worthy of a trial.

WILLIAM THORBURN.

Alfred New Town, Ashford, Kent, July, 1852.

CRYSTAL PALACE SEA-BATHING.

The directors of the Crystal Palace Company have just now under consideration a scheme for laying down incorrodible pipes, opening into the sea at Brighton at one end, and into the grounds of the Sydenham building at the other, so as to afford the visitors from the metropolis the luxury of a salt-water plunging and swimming bath. The mains will be laid along the slopes of the Brighton Railway; so that, after making due arrangements with the company, the formation of the line of pipes will be an easy matter, and the great object of securing to the pent-up citizens the salubrious recreation of sea-bathing, without entailing upon them the expense and loss of time of journeying to the sea's margin, will be accomplished.

Such a scheme, I should say, is deserving of public notice; for, connected as it will be with the grand rural exhibition, its advantages must be great indeed. Those who can now only command fresh-water, so vastly inferior to that of the sea, will, I should say, gladly avail themselves of the opportunity of a cheap and pleasant ride for securing such a luxury. By a possible extension of the plan, the water, when once at the Sydenham reservoir, may be carried on and distributed throughout the palaces, hospitals, baths, and hotels of London. Besides its application to sanitary purposes, the water may also be used for the ornamental works of the building, which, by this acquisition, will surpass the hitherto unequalled jets-d'eau of Versailles, or the noble cascades of St. Cloud. Careful calculations by Mr. Wright, the projector, show that the metropolis can be supplied with 100 gallons for 3d., or a good bath for 1d. It is remarkable enough, that, notwithstanding our wealth, our boasted civilisation and mechanical skill, we fall infinitely short of the Greeks and Romans of ancient, and of most European countries of modern times, in this point of national baths. However, with the introduction of the marine water supply, we shall accomplish the greatest existing achievements—well worthy of our age, and the scientific and mechanical pre-eminence of the British nation.

C. L. JUN.

London, July, 1852.

TEAL'S THERMOMETRIC VENTILATOR.

Mr. Teal's thermometric ventilator is another of the many curious instances of different parties thinking of the same thing, and arriving at the same conclusions. In April last, I was led by the description of Dr. Arnot's self-regulating ventilator—which a friend of mine had put up in his bed-room—to invent a ventilator, to act on the thermometric principle of Mr. Teal. Being occupied at the time, I allowed the idea to stand over until I could find leisure to work it out, anticipating the pleasure of sending it for insertion in the *Practical Mechanic's Journal.* Mr. Teal has, however, anticipated me.*

BERTRAM MITFORD.

Northumberland Lodge, Tivoli, Cheltenham.

WHITELAW'S DIFFERENTIAL BEAM ENGINES.

Amidst the many hundreds of would-be improvements in the steam-engine, Whitelaw's patented invention—so lengthily described and minutely illustrated in the July Part of the *Practical Mechanic's Journal* —is deserving of some remark. I have observed that those who have modified the construction, or otherwise simplified the details of machinery, too often seek to invest their improvements with advantages which they do not possess, and which, in other situations, would at once appear erroneous. Such I consider to be the case in the instance before us—in claiming for the new engine a superiority of effect, on account of the mere unequal division of the beam. I will not enter into the calculations from which the anomaly is proved. It is sufficient to remark, that I have often seen calculations of this kind suited to similar purposes; and I would merely appeal to the first general principles of mechanics, which authoritatively tell us that it is impossible, by the simple lengthening of a lever, to get an increase of power, without, at the same time, reducing the rate of action. In other words, with two engines of the same size of cylinder, length of stroke and number of strokes, no augmentation of useful effect can arise by giving either of them a beam with a long and short end. In the article on Mr. Whitelaw's plan, this is clearly admitted; for it states that there will be less pressure on the crank pin of the new engine, and that it may therefore be proportionately smaller. Now, allowing that there will be a slight diminution of friction, can any impartial mechanic doubt for a moment that it will not be more than counterbalanced by the increased friction on the piston-rod guides. I think so, at least, and I believe that this will turn out to be a very great defect in the working of the engine; and, with all due deference, I humbly suggest that a short-stroked engine, with an equally-divided beam, will be fully as effective, and a far more mechanical job, than the differential beam engine, whilst it will answer the same purpose, and take up as little room. The modification of the governor is also, in my opinion, a step backwards, instead of forwards. In Field's governor, the projection is placed spirally on the cam, or rather the cam itself is a spiral, sliding on a straight feather; whereas Mr. Whitelaw makes his cam straight, and causes it to slide on a spiral feather. The consequence is, that whilst Field's governor has only the weight of the cam to raise, Whitelaw's has the weight of the cam, plus the power required to twist it round on the spiral. Moreover, there is a great objection to the cam working on a spiral feather; for in addition to its being very unmechanical, and difficult to fit, the pressure on the cam, when the latter opens the valve, will incline it to run up or down the spiral, just as the thread may be cut; therefore the governor will not act so well as in Field's arrangement. The two screws, with their accompanying star-wheels, may, I think, be classed amongst the endless gimcracks, which have their day of laudation, and at last pass away to the scrap heap.

This brings me now to the equilibrium slide valve, to insure the perfect action of which, two pumps, with all their details of valves, rods, and pipes, are required. What a complication have we here, for the attainment of an end, which, after all, is of very doubtful accomplishment. For, should the steam pressure be lowered, a very nice little condensing apparatus would be formed in the steam-chest, and not a regenerative one either, but one which would commit sad havoc with pistons and cylinder ends. I am aware that a provision after a sort is made for this; but a very slight wear would allow a thin film of water to pass through, to the great damage of the cylinder, as well as waste of fuel, from the condensation of the steam. But there is another point from which this scheme may be viewed, and that is the great pressure required to effect the desired end. Suppose the valve to be 12 inches square—which, although a bad proportion, would be as favourable to Mr. Whitelaw as he could wish; and suppose the ports to be 1½ inch wide, his water space could not be more than 8 inches long, by say 1 inch wide; and suppose the steam in the valve chest to be 40 pounds,—the pressure required to balance this would be 2,830 pounds, or 353 pounds per square inch, a pressure too enormous to be thought of for a moment for such a purpose.

J. F.

Derby, July, 1852.

* Page 46, for May.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

ROYAL SCOTTISH SOCIETY OF ARTS.

MONDAY, 14th JUNE.

This was the last meeting of the session. The following papers were read:—

"A Pictorial Exposition of the origin and progress of the Britannia Tubular Bridge, with Models illustrating the mode of joining and riveting the Plates."—By George Lees, LL.D., President.

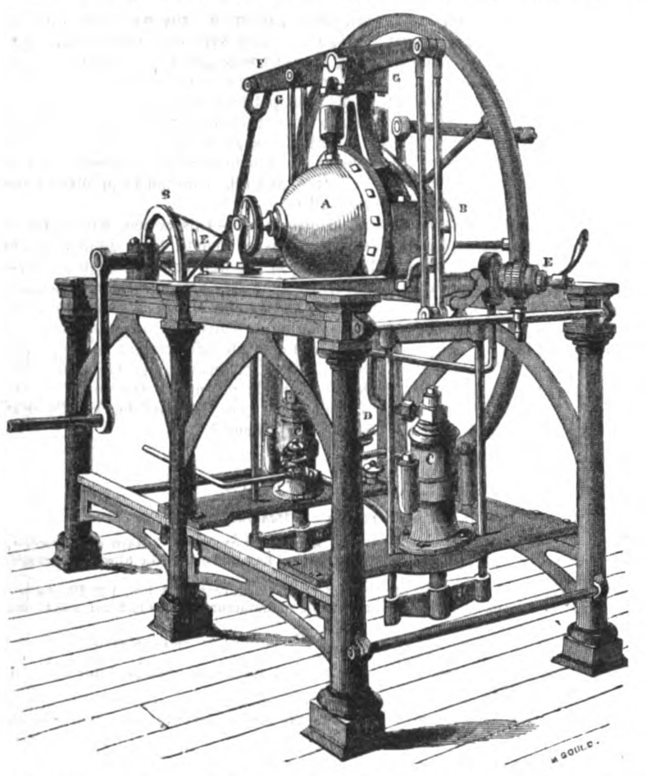
"Description and two Drawings of a Design for a Table-Lamp in Silver or Brass in the Victorian Style, convertable into a Flower-stand."—By Mr. Randall P. Dale, 5 Buccleuch Place, Edinburgh.

"Description and Drawing or Design for a Fountain."—By Mr. John Tod Alexander, Rustic Work Manufacturer, Dumfries.

MONTHLY NOTES.

THE CORK EXHIBITION.—Although rich in the chief staple productions of Ireland, the Cork Exhibition of "arts, manufactures, and materials," presents little for the consideration of the mechanic. In fact, with the exception of a small engine, and a pair of locomotive connecting rods, from the works of the Great Southern and Western Railway, and a capstan mill, and centrifugal pump, by Perrott & Co., of Cork—fair enough specimens in their way—there is nothing worth noting.

Tyler and Hayward's Continuous Principle Soda-Water Machine.—Few drinkers of what we term soda-water are aware that its refreshing effervescence is derived from a mixture of sulphuric acid, or the vitriol of commerce, and common chalk. There is, in fact, only a chemically-minute portion of soda in it, its pungent and exhilarating qualities being derived from the fixed air, or carbonic acid gas, which is evolved from chalk and acid in contact. Its manufacture involves a large amount of capital, and employs many hands—its machinery being both complicated and expensive in first cost, as the examples in the late Exhibition would evidence. Perhaps the most complete and best-finished machine in that collection, was that by Messrs. Tyler, Hayward, & Co., of London, as delineated in the annexed perspective figure. It combines two distinct machines within one frame, and they may be worked together or separately at pleasure. The



condenser is at A; it is cylindrical, with hemispherical ends, as it has to resist an immense pressure. It is divided across the centre to form two separate generators, and is coated internally with silver to prevent corrosion—the body being of gun-metal. Each half of this generator has an agitator driven by a winch, through the pulleys and bands, B, so as to stir up the gas and water. The condensing pumps are at C, each fitted with regulating cocks, D, for governing the admission of the gaseous fluid. A bottler stands at each end, and receives the soda-water from the bottling cocks, E, the two pumps drawing the fluid by pipes from the generator—which is not shown in our view—and forcing it into the condensers. The pumps are worked by a beam, F, having a connecting-rod at one end, jointed to a driving crank, the connection with the pumps being through the side-rods, G, and cross-tails, H. About ten minutes is consumed in getting up the charge, and the bottling then goes on at the rate of 300 dozen per day, without interruption, the apparatus being in constant motion during bottling. The cocks being duly regulated, and the supply kept up, as much carbonic acid gas and water will be forced into the condenser as will make up for that drawn off, and hence the supply is continuous.

Government Trials of Anchors.—The first series of these very important experiments, to the conditions of which we some time ago drew attention, has now been gone through at Sheerness. The proceedings commenced, as we previously announced, on the 1st of July, the committee of management assembling at the office of Captain C. Hope, superintendent of the dock-yard, when the following suggestions, as to the proper qualities of a good bower anchor, and the conditions of the trial, were read over and agreed to:—

"Proper qualities for a good bower anchor, viz.:—Strength; holding, particularly when at a short stay, and being obliged to make sail; weight, and facility for stowage: quick holding; sweeping; tripping; fouling; fishing in a heavy seaway, and stowing.

"*First Trial Plan.*—At the testing-ground in the dock-yard. A fourfold purchase to be attached to each anchor, the falls to be toggled to a pendant and jewel-block, with one purchase to be brought to a capstan.

"The testing-ground to be marked for the anchors, and their turn for trial to be drawn for. From the capstan, those to the right will be marked 'Starboard,' and those to the left 'Port.' Numbers to commence from the extreme ends of the testing-ground.

"The pee of the anchor to be placed in its berth according to the number drawn, and after testing their burying properties, the cables (being already rove in the testing-blocks) are then to be triced to the sheerheads, agreeably to the wishes of the committee, to test their holding qualities with a short scope of cable.

"*Second Trial Plan.*—At the testing-ground on the beach the same rules are to be observed as in the dock-yard, and another turn for trial to be drawn for. The pee of the anchor to be placed at low-water mark, if agreeable to the wishes of the committee; the purchase to be nearly the same as that used in the dock-yard, with one capstan. Hemp cables to be used, if sheers are required; if otherwise, chain.

"*Third Trial Plan.*—A mooring lighter to be moored at the Little Nore, her rudder to be unshipped, the bridles to be of hemp, attached to the moorings, to be taken in over the stern with a sufficient length to veer, if required, 30 or 40 fathoms; the size of the cable to be 15 inches; the moorings to be laid across the tide, in order that the trials may take place with the flood or ebb tide. Another turn for trial to be drawn for.

"*Fourth, or Steam Trial, as per Plan.*—A steamer of not less than 300 horse-power to be used; both anchors for testing to be let go at the same time, the depth of water and the speed of the steam (to go with a back turn) agreeably to the wishes of the committee."

The following resolutions, determined on at a previous meeting of the anchor committee, were then submitted to the parties assembled:—

"1. That the committee approve of Mr. J. Aylen's plan for trying the anchors in the parade-ground of the dock-yard, on the beach, under water, and at sea, and that the same be adopted.

"2. That the trials be open to anchors of all nations. That the weight of each anchor be 25 cwt., inclusive of the stock.

"3. That such of the anchors as the committee shall consider to have proved themselves superior at the preliminary tests, should be afterwards subjected to such further ones as the committee may decide on, by means of two steamers at sea, with regard to holding, bringing up, and tripping."

The competitors then adjourned to the parade-ground, fitted up with Mr. Aylen's apparatus and gear, ingeniously contrived, to prevent any deception or unfair play; and the parties then drew lots for their respective stations, as under:—

STARBOARD.	PORT.
1. Mr. Honibal (Patentee of Porter's anchor).	1. Mr. J. Aylen, Master-Attendant.
2. Mitcheson and Son.	2. Mr. Isaacs (American anchor).
3. Lieutenant Rodgers, R.N.	3. Mr. Trotman (improved Porter's).
4. Mr. G. W. Lennox.	4. Admiralty (new).

In accordance with these arrangements, Honibal's anchor, total weight 24 cwt. 3 qrs. 20 lbs., was opposed to Aylen's, of 24 cwt. 2 qrs. 24 lbs. At a long scope of cable Aylen's came home 3 feet $7\frac{1}{2}$ inches; Honibal's, 1 foot 6 inches. The position of the gear being changed, so as to have the effect of a ship riding at a short-stay peak, Aylen's broke out of the ground at 9 feet 7 inches, or 13 feet $2\frac{1}{2}$ inches total distance from first position; Honibal's holding on, settling $2\frac{1}{2}$ inches only.—Mitcheson and Son's anchor, weighing 25 cwt. 8 lbs., was then tried against Isaacs' American anchor, of 25 cwt. 17 lbs. At long scope of cable, Mitcheson's dragged 1 foot 6 inches; Isaacs', 5 feet 7 inches. At short-stay peak, Isaacs' was lifted out of the ground at 11 feet 6 inches total distance from first position, Mitcheson's holding on at 1 foot $8\frac{1}{4}$ inches total distance.—The two next anchors tested were Trotman's improved Porter's, and Lieut. Rodgers', R.N., Exhibition prize anchor, the total weight of the former being 25 cwt. 6 lbs.; that of the latter 24 cwt. 2 qrs. 22 lbs. Rodgers' drew 5 feet; Trotman's, 3 feet $7\frac{1}{4}$ inches. Rodgers' came out of the ground at 18 feet total distance, Trotman's drawing only $2\frac{1}{4}$ inches, holding on at 3 feet $9\frac{1}{2}$ inches total distance from first position.—The anchor invented by Mr. G. W. Lennox, the contractor for cables and anchors used in the navy, was then tried against the Admiralty anchor, constructed on Sir W. Parker's plan. Their weights were 24 cwt. 1 qr. 25 lbs., and 25 cwt. respectively. At long scope Lennox's drew 2 feet $7\frac{1}{2}$ inches; the Admiralty, 1 foot $6\frac{1}{2}$ inches. At short-stay peak Lennox's broke out of the ground at 17 feet 11 inches, the Admiralty's having drawn a total distance of 10 feet $8\frac{1}{2}$ inches.—The four best anchors were then opposed to each, after the fashion of a wrestling match, where the thrown men are left out—Honibal's being opposed to Mitcheson and Son's anchor. At long scope, Mitcheson's dragged 5 feet 6 inches; Honibal's, 4 feet $4\frac{1}{2}$ inches. At short-stay peak, Mitcheson's came out of the ground at 24 feet $4\frac{1}{2}$ inches, Honibal's dragging 6 feet $8\frac{1}{2}$ inches, total distances.—The next contest was between the Admiralty and Trotman's anchors. The former, at long scope, drew 6 feet 8 inches, the latter 4 feet $10\frac{1}{2}$ inches. At short-stay peak the Admiralty anchor was forced out of the ground at a total distance of 22 feet 10 inches, Trotman's drawing 9 feet 11 inches, but still holding on. Thus the competing anchors were reduced to two, viz., Honibal's and Trotman's. These partaking of the same principle, the greatest possible interest was evinced by the jury and all assembled as to the result of the trial. Honibal's at long scope drew 5 feet, Trotman's 6 feet 5 inches. After a most severe contest at short-stay peak, the great strain applied making the blocks and gear creak, Honibal's was eventually wrenched out of the ground at 16 feet 6 inches, total distance, as against 10 feet 2 inches for Trotman's, which held on.—These represent bower anchors, combining the two great essentials—strength and holding power.—Lieut. Rodgers, R.N., having sent in an anchor, which he designates a stream kedge, possessing holding power without sufficient strength, the committee at the onset considered it ineligible for trial. Lieut. Rodgers, however, evincing great anxiety that it should be tried against Trotman's, which had in this series of experiments proved itself the most efficient, the committee appealed to Mr. Trotman on the subject, who accepted the challenge.—The anchors being placed port and starboard respectively, the gear attached, and strain applied, Rodgers' at long scope dragged 7 feet $8\frac{1}{2}$ inches; Trotman's, 6 feet. At short-stay peak, Rodgers' was pulled out of the ground at 24 feet 6 inches;

Trotman's holding on at 9 feet 1 inch—total distances from first position.—Mitcheson and Son's anchor was then opposed to the Admiralty new one. The strain being applied, Mitcheson and Son's, at long scope, drew 1 foot 6½ inches; the Admiralty's, 8 feet 7 inches. At short-stay peak the Admiralty anchor was lifted out of the ground at a distance of 14 feet 9½ inches from its first position, Mitcheson's firmly holding on, and not dragging the least.—The great confidence of Mr. Trotman in the efficiency of his anchor, weighing 25 cwt. 8 lbs., induced the committee to allow it to be tested with one of the new Admiralty anchors, weighing 30 cwt. 1 qr. 17 lbs. At long scope the Admiralty anchor was drawn 3 feet 10 inches, and Trotman's 6 feet. At short-stay peak, the Admiralty anchor came out of the ground at 19 feet 3 inches total distance from first position, Trotman's having only moved one inch, thus having drawn its opponent 15 feet 5 inches.—Mitcheson's anchor was then tested with Rodgers' stream kedge. At long scope, Mitcheson's dragged a distance of 6 feet 4½ inches, while Rodgers' drew 7 feet 7 inches. At short-stay peak, Rodgers' was lifted out of the ground at 24 feet total distance, Mitcheson's holding on at 6 feet 9 inches, having moved only 4½ inches, or a total distance of 6 feet 9 inches.—The next trial then took place, by opposing Mitcheson and Son's anchor to that of Mr. G. W. Lennox. At long scope, Mitcheson's dragged 4 feet; Lennox's, 7 feet 11 inches; the latter, at short-stay peak, was wrenched out of the ground at a total distance of 22 feet 4½ inches, Mitcheson's holding on at 6 feet total distance, having dragged its opponent 14 feet 5½ inches. —So far as the trials have gone, it would appear that the three best anchors are Trotman's, Honibal's, and Mitcheson and Son's, in the order here placed. The committee, however, have very properly determined not to give any opinion as to their merits until the whole series of experiments are concluded.

THE BRITISH ASSOCIATION AT BELFAST.—The 22d meeting of the British Association has been fixed for the 1st of September at Belfast, the industrial capital of Ireland. For the benefit of interested readers and intending visitors, we append the programme of the office-bearers of the year:—President—Col. Edward Sabine, R.A., Treasurer and Vice-President of the Royal Society. Vice-Presidents—The Earl of Enniskillen, D.C.L., F.R.S.; the Earl of Rosse, M.A., M.R.I.A., President of the Royal Society; Sir Henry T. De La Beche, C.B., F.R.S., Director-General of the Geological Survey of the United Kingdom; the Rev. Edward Hincks, D.D., M.R.I.A.; the Rev. P. S. Henry, D.D., President of Queen's College, Belfast; the Rev. T. R. Robinson, D.D., F.R.A.S., President of the Royal Irish Academy; George Gabriel Stokes, F.R.S., Lucasian Professor of Mathematics in the University of Cambridge; John Stevely, LL.D., Professor of Natural Philosophy in Queen's College, Belfast. General Secretary—J. Forbes Royle, M.D., F.R.S., Professor of Materia Medica and Therapeutics in King's College, London. Assistant General Secretary—John Phillips, Esq., F.R.S., York. General Treasurer—John Taylor, Esq., F.R.S., 6 Queen Street Place, Upper Thames Street, London. Secretaries for the Belfast Meeting—W. J. C. Allen, Esq., 8 Wellington Place; William M'Gee, M.D., Donegall Square, East; W. P. Wilson, M.A., Professor of Mathematics in Queen's College, Belfast. Treasurer for the Belfast Meeting—Robert Patterson, Esq., High Street.—The following are the Sections to which communications may be presented:—Section A, Mathematics and Physics, Professor W. Thomson, M.A., F.R.S.L. & E., President; Section B, Chemistry and Mineralogy, including their applications to Agriculture and the Arts, Thomas Andrews, M.D., F.R.S., M.R.I.A., President; Section C, Geology and Physical Geography, Lieut.-Col. Portlock, R.E., F.R.S., President; Section D, Zoology and Botany, including Physiology, William Ogilby, Esq., F.L.S., President; Section E, Geography and Ethnology, Col. Chesney, R.A., D.C.L., F.R.S., President; Section F, Statistics, His Grace the Archbishop of Dublin, President; Section G, Mechanical Science, James Walker, Esq., C.E., F.R.S., L. & E., President.—These appointments will be submitted for confirmation, and the Vice-Presidents and Secretaries appointed, at the meeting of the general committee, Wednesday, September 1.

METROPOLITAN STREET RAILWAY COMPANY.—London has long been going out of town—filling up its formerly isolated villages, until they swell into vast out-stretching arms of the city itself. From Poplar to Hounslow in one direction, and from Clapham to Highgate in the other, we have respectively fifteen and nine miles before us; and from these and their collateral suburbs, the city daily draws within its vortex 250,000 persons. To occupy this field of conveyance, and to battle with the confusion arising from the existing systems of conveyance, a *Metropolitan Street Railway Company* has been announced as in process of formation. The professed object of this scheme, is to lay down two lines of rails in the streets, and flush with the road surface, the carriages upon these rails to be drawn by horses. The rails are to be laid in the middle of the road, but the ground they cover is to be available besides for all ordinary traffic. Such lines would undoubtedly have a tendency to clear the streets, by facilitating conveyance of every kind; but seeing that the lines are to be common to all kinds of traffic, it is impossible to overlook the evident fact that "blocks" will still occur, especially in streets where the unwieldy waggons, with their long cumbrous strings of six horses, are to be met with.

RECENT PATENT LAW CASES.

Berrington's Knapsack Extension.—After a fruitless existence of nearly fourteen years, another chance of bringing this important invention into use has been secured by Mr. Berrington in a five years' prolongation. On the application coming before the Privy Council, satisfactory evidence was adduced as to the superiority of Mr. Berrington's invention over the "regulation" knapsack—the chief points being, that it brought the carried weight upon the transverse plane of the body, the respiration being unimpeded, and the arms free, whilst in the water it acts as a float. Mr. Angelo, the instructor of the sword exercise in the army, indeed expressed his belief that nine out of ten infantry men became flat-chested, a deformity attributed, in a great measure, to the use of the regulation knapsack. In giving judgment, Dr. Lushington expressed his surprise that an invention, apparently so valuable, should not yet have been adopted in a single regiment, but as there was nothing to show that it had at all failed in its object, an extension of five years would be recommended.

Heywood v. *Potter—(Paperhangings) Infringement.*—The decision in this case sets at rest a very frequently raised question. It is this—Is a manufacturer, as a calico-printer or paperhanging producer, bound to stamp the registration mark upon the patterns which he sends out to the retail trade, prior to the actual appearance in the market of the fabrics which they represent? In other terms, what is the construction to be put upon that clause of the *Designs Act*, which directs that no person shall be entitled to its benefits, unless every registered article is duly marked. In the present case, small pattern lengths were cut from the piece, for the inspection of the retailer to whom they were sent, without the registration mark. On these admitted facts, a verdict was agreed to be entered for the plaintiff, subject to the opinion of the court as to the clause involved. On evidence being given as to the practice of sending out patterns stamped or unstamped, it was shown to be the general rule to stamp them; therefore Lord Campbell held the action to be not maintainable, and a verdict was given for the defendant, with leave for the plaintiff to move for a new trial. Originators and proprietors of new designs will probably take the hint in future, and take care not to publish in any shape until duly protected by the legal marks.

Newall v. *Wilson—(Wire Ropes) Infringement.*—This action, which has so long engaged the attention of the courts, has at length been decided in the plaintiff's favour. The plaintiff, Mr. Newall, of the well-known Gateshead Wire-rope Works, obtained his patent, embodying some very valuable improvements in this now extensive manufacture, in August, 1840; and Mr. J. B. Wilson of Newton, Lancashire, subsequently patented some improvements of a similar nature in November, 1849—the latter being alleged to be an infringement of the earlier patented process. The result of the consequent extensive litigation is, that Mr. Wilson has taken a license to work Mr. Newall's patent for the remaining two years of its existence, a mode of settlement which Lord Campbell has rightly characterised as "a most rational and proper arrangement."

ENGLISH PATENTS.

Sealed from 18th June, to 15th July, 1852.

William Cardwell M'Bride, of Alistragh, Armagh, farmer,—"Certain improvements in machinery for scutching, or otherwise preparing flax and other like fibrous materials."—18th June.

Richard Archibald Brooman, of the firm of J. C. Robertson & Co., 166 Fleet-street, London, patent agents,—"Improvements in the manufacture of wheels, tyres, and hoops."—(Communication.)—18th.

William Edward Newton, Chancery-lane, civil engineer,—"Improvements in the construction of fences."—(Communication.)—19th.

William Burgess, Newgate-street, gutta percha merchant,—"Improvements in the manufacture of gutta percha tubing."—21st.

Jean Baptiste Georges Landes, Paris, civil engineer,—"Certain improvements in locomotive engines, part of which improvements are also applicable to other engines."—24th.

Claude Arnoux, Paris, gentleman,—"Certain improvements in the construction of railway carriages"—24th.

Alexander Johnston Warden, Dundee, manufacturer,—"Improvements in the manufacture of certain descriptions of carpets."—24th.

James Higgin, Manchester, manufacturing chemist,—"Certain improvements in bleaching and scouring woven and textile fabrics and yarns."—24th.

Joseph Swan, Glasgow, North Britain, engineer,—"Improvements in the production of figured surfaces, and in printing, and in the machinery or apparatus used therein."—24th.

George Pearson Renshaw, Park, Nottingham, civil engineer,—"Improvements in cutting and shaping."—24th.

James Edward M'Connell, Wolverton, Bucks, civil engineer,—"Improvements in steam-engines, in boilers, and other vessels for containing fluids, in railways, and in materials and apparatus employed therein, or connected therewith."—24th.

Joseph Hart Mortimer, Hill-street, Peckham,—"Improvements in lamps."—24th.

Samuel Lusty, Birmingham,—"Improvements in manufacturing wire into woven fabrics and pins."—24th.

Thomas Bell, Don Alkali Works, South Shields,—"Improvements in the manufacture of sulphuric acid."—24th.

Joseph Morgan, Manchester, patent candle machine manufacturer, and Peter Gaskell, of the same place, gentleman,—"Improvements in the manfacture of candles."—24th.

Charles James Wallis, Clarendon-chambers, Handcourt, Holborn, civil engineer and mechanical draughtsman,—"Improvements in machinery for crushing, pulverising, and grinding stone, quartz, and other substances."—24th.

Thomas Bazley, Manchester, cotton spinner,—"Improvements in machines for combing cotton, flax, silk, and other fibrous materials."—24th.

John M'Conochie, Liverpool, engineer,—"Improvements in locomotives and other steam-engines and boilers, in railways, railway carriages, and their appurtenances; also in machinery and apparatus for producing part or parts of such improvements."—24th.

Thomas Allan, Edinburgh, engineer,—"Improvements in producing and applying electricity, and in apparatus employed therein."—24th.

Thomas Hoblyn, Whitebarns, Hertford, Esq.,—"Certain improvements in the art of navigation."—28th.

Matthew Augustus Crooker, engineer, City of New York, America,—"Certain improvements in paddles for steam vessels."—28th.

James Edward Coleman, Porchester House, Bayswater, gentleman,—"Improvements in the application of India-rubber and gutta-percha, and of compounds thereof."—28th.

Duncan Mackenzie, of London, gentleman,—"Certain improvements in machinery and apparatus for reading in and transferring designs or patterns, and for cutting, punching, and numbering, or otherwise preparing perforated cards, papers, or other materials used or suitable in the manufacture of figured textile fabrics, by Jacquards or other weaving looms or frames."—29th. *

Lazare François Vandeline, Upper Charlotte-street, Fitzroy-square,—"Improvements in obtaining wool, silk, and cotton, from old fabrics, in a condition to be again used."—(Partly a communication.)—30th.

* For a description of these vessels, see page 33, Vol. IV., *P. M. Journal.*

Richard Hornsby, Spittlegate, Grantham, Lincoln, agricultural implement-maker,—"Improvements in machinery for thrashing, shaking, riddling, and dressing corn."—3d July.

Edward Clarence Shepard, Duke-street, Westminster, gentleman,—"Improvements in electro-magnetic apparatus suitable for the production of motive power, of heat, and of light."—(A communication.)—6th.

Martyn John Roberts, Woodbank, Bucks, gentleman,—"Improvements in the production of electric currents, in obtaining light, motion, and chemical products and effects by the agency of electricity, part or parts of which improvements are also applicable to the manufacture of acids, and to the reduction of ores."—6th.

William Tanner, Exeter, leather-dresser,—"Improvements in dressing leather."—6th.

Edward Maitland Stapley, Cheapside,—"Improvements in cutting mouldings, grooves, tongues, and other forms, and in planing wood."—(A communication.)—6th.

Moses Poole, Patent-office, London, gentleman,—"Improvements in reaping and mowing machines, and in pulverizing land."—(A communication.)—6th.

Thomas Blakey and Joseph Skaife, Keighley, York, millers,—"Improvements in mills for grinding."—6th.

James Higgins, Salford, Lancaster, machine-maker, and Thomas Schofield Whitworth, of the same place, mechanic,—"Certain improvements in machinery or apparatus for spinning and doubling cotton and other fibrous substances."—6th.

Harold Potter, Over Darwen, Lancaster, carpet-manufacturer, and Matthew Smith, of the same place, manager,—"Certain improvements in looms for weaving, and in the manufacture of terry fabrics."—6th.

Jules Lemoine, chemist, Courbevoie, near Paris,—"An improved composition applicable to the purposes of varnish, to the waterproofing of fabrics, to the manufacture of transparent fabrics, to the fixing of colours, and to other useful purposes."—6th.

John Henry Johnson, 47 Lincoln's Inn-fields, Middlesex, and of Glasgow, North Britain, gentleman, "Improvements in steam-engines."—(A communication.)—6th.

Alfred Henry Gaullie, Paris, sculptor,—"An improved plastic composition applicable to manufacturing purposes."—6th.

William Septimus Losh, Wreay Syke, Cumberland, gentleman,—"Improvements in obtaining salts of soda."—6th.

James Murdoch, Staple-inn, Holborn, Middlesex,—"An improvement in the manufacture of certain kinds of woollen fabrics."—(A communication.)—6th.

John Andrews, Fair Oak-terrace, Minde, Newport, Monmouthshire, contractor,—"Certain improvements in coke ovens, and in the apparatus connected therewith."—6th.

Frederick Sang, Pall-mall, artist in fresco,—"Certain improvements in machinery or apparatus for cutting, sawing, grinding, and polishing."—6th.

Friedrich Gesswein, Cannstadt, Wurtemberg, stone-mason,—"A method of preparing for baking and burning masses of clay of any given form and size, and baking and burning the same when so prepared, as thoroughly and completely as a common brick can now be baked or burnt."—6th.

John Ramsden, Manchester, screw-bolt manufacturer,—"Certain improvements in machinery or apparatus for cutting screws."—6th.

Joseph Jepson Oddy Taylor, Gracechurch-street, London, machinist,—"An extension for the term of four years, from the 1st day of May last, for part of his invention described in the original letters patent under the title of 'An improved mode of propelling ships and other vessels on water.'"—6th.

Warren Stormes Hale, Queen-street, Cheapside, candlemaker, and George Roberts, Great Peter-street, Westminster, miner,—"Improvements in the manufacture of night lights or mortars."—8th.

Alfred Vincent Newton, Chancery-lane, mechanical draughtsman,—"Improvements in machinery for cutting soap into slabs, bars, or cakes."—(A communication.)—10th.

Thomas Jordan, Old Broad-street, London,—"Improvements in disinfecting essential oils, and in treating fatty matters obtained from shale schistus, or other bituminous substances, and in retorts employed in distilling such minerals."—12th.

Joseph Baron Palur, Castle-street, Holborn,—"An improved mode of baking bricks, tiles, and other kinds of pottery or earthenware."—13th.

Charles Burrell, Thetford, Norfolk, and Matthew Gibson, Rollington-terrace, Newcastle-on-Tyne,—"Improvements in reaping machines."—15th.

George Hinton Bovill, Abchurch-lane, London,—"Improvements in manufacturing wheat and other grain into meal and flour."—15th.

Moses Poole, Patent Office, London, gentleman,—"Improvements in boots, shoes, clogs, and similar articles."—(A communication.)—15th.

Henry John Gauntlett, Charlotte-street, Portland-place, Middlesex, doctor in music,—"Improvements in organs, seraphines, and other similar wind instruments, and also improvements in pianofortes."—(A communication.)—15th.

Charles Barrington, Philadelphia, America, gentleman,—"An improved steam-boiler water-feeding apparatus, and furnace therefor."—(A communication.)—15th.

Charles James Pownall, Addison-road, Middlesex, gentleman,—"Improvements in the treatment and preparation of flax, and other similar fibrous vegetable substances."—15th.

Thomas Richards, St. Erth, and Samuel Grose, Gwinear, both in Cornwall,—"Certain improvements in machinery for reducing and pulverizing ores, minerals, stones, and other substances."—15th.

IRISH PATENTS.

Sealed from 25th May to 18th June, 1852.

Julian Bernard, now of Guildford-street, Russell-square, but late of Green-street, Grosvenor-square, both in the county of Middlesex, gentlemen,—"Improvements in the manufacture of leather or dressed skins, of the materials to be used in lieu thereof, of boots and shoes, and in materials, machinery, and apparatus connected with or to be employedin such manufactures."—25th May.

Stewart M'Glashen, Edinburgh, Scotland, sculptor,—"The application of certain mechanical powers to lifting, removing, and preserving trees, houses, and other bodies."—26th.

Jean Theodore Coupier, and Maria Amedee Charles Mellier, both lately residing at Maidstone, in the county of Kent, but at present of Golden Bridge Mills, near Dublin, gentlemen,—"Certain improvements in the manufacture of paper."—2d June.

Peter Fairbairn, Leeds, York, machinist, and Peter Swires Horsman, Leeds, aforesaid, flax-spinner,—"Certain improvements in the process of preparing flax and hemp for the purpose of heckling, and also machinery for heckling flax, hemp, China grass, and other vegetable fibrous substances."—3d.

William Hindman, Manchester, Lancaster, gentleman, and John Warhurst, Newton Heath, near Manchester, cotton dealer,—"Certain improvements in the method of generating or producing steam, and in the machinery or apparatus connected therewith."—3d.

Richard Archibald Brooman, of the firm of J. C. Robertson & Co., 166 Fleet-street, London, patent agent,—"Improvements in presses and pressing, in centrifugal machinery, and in apparatus connected therewith, part or parts of which are applicable to various useful purposes."—(A communication from abroad.)—3d.

Richard Archibald Brooman, of the firm of J. C. Robertson & Co., 166 Fleet-street, London, patent agents,—"Certain improvements in the preparation and treatment of fibrous and membraneous materials, both in the raw and manufactured state, in applying electro-chemical action to manufacturing purposes, and in the manufacture of saline and metallic compounds."—(A communication from abroad.)—4th.

William Cardwell M'Bride, Alistragh, Armagh, farmer,—"Certain improvements in machinery for scutching or otherwise preparing flax, and other like fibrous materials."—4th.

William Watt, Glasgow, Lanark, North Britain, manufacturing chemist,—"Improvements in the treatment and preparation of flax or other fibrous substances, and the application of some of the products to certain purposes."—15th.

DESIGNS FOR ARTICLES OF UTILITY.

Registered from 10th June to 14th July, 1852.

June 10th,	3294	T. & C. Clark & Co., Wolverhampton,—"Apparatus for frying and boiling at the same time."
—	3295	R. Lancaster, Bolton-le-Moors,—"Miner's safety lamp."
—	3296	M. A. Biggs, and A. P. Collins, Berkeley-street, Clerkenwell,—"Letter spring."
—	3297	M. A. Biggs, and A. P. Collins, Berkeley-street, Clerkenwell,—"Card case."
11th,	3298	J. T. Campion, Exeter,—"Mould for casting hollow, or Minié rifle bullets."
—	3299	A. Jackson, Orpington, Kent,—"Tray and apparatus for a tea or coffee-pot and cups."
14th,	3300	Parker, Field, & Son, High Holborn,—"Spring ramrod to be attached to, for the purpose of loading single barrel revolving-chambered pistols."
—	3301	C. W. Lancaster, New Bond-street,—"Gun-ball patch."
15th,	3302	J. Mather, Newcastle-on-Tyne,—"Bread and pastry oven."
—	3303	Lenox & Jones, Billiter-square,—"Anchor."
16th,	3304	T. Reid, Monkton, Ayrshire,—"Combined double mould board plough, seed sower, and manure sowing rutter.
17th,	3305	H. Thomas, Birmingham,—"Pick-axe."
17th,	3306	H. Thomas, Birmingham,—"Pick-axe."
18th,	3307	Hodges, Brothers, Noble-street,—"Vest front."
19th,	3308	A. Suter, Fenchurch-street,—"Ventilating windguard."
20th,	3309	S. Rooke, Birmingham,—"Tubular oilcloth cover for cornice poles."
22d,	3310	J. Southgate, Watling-street,—"Portmanteau."
23d,	3311	J. Southgate, Watling-street,—"Expanding portmanteau."
29th,	3311	Taylor & Pace, John-street, Hackney,—"Heating apparatus for baths."
—	3313	T. Allan, Edinburgh,—"Electrode."
30th,	3313	T. Hills & Son, Cooper-street, City-road,—"Gold washing and reserving machine."
July 2d,	3314	H. E. Campbell, Guildford-street,—"Horizontal gold washing machine."
—	3315	B. Samuelson, Banbury, Oxford,—"Part of a lawn mower."
3d,	3316	W. Dray & Co., Swan-lane, London Bridge,—"Combined winnowing and blowing machine."
5th,	3317	W. Tasker and G. Fowle Andover, Hants,—"Convex clod-crusher or press-wheel roller."
—	3318	J. Duncan, Gresham-street, West,—"Marquise joint."
6th,	3319	W. Dray & Co., Swan-lane, City,—"Part of a reaping and mowing machine."
—	3320	F. Barnes, Union-row, Tower-hill,—"Gold-washing machine."
7th,	3321	J. Higham, Manchester,—"Bugle."
—	3322	R. Garrett, Saxmundham,—"Manure distributor."
—	3323	Ransomes & Sims, Ipswich,—"Spherical locking-carriage."
8th,	3324	C. Burrell, Thetford,—"Force pump discharge apparatus."
9th,	3325	W. Hensman & Son, Woburn, Bedfordshire, and S. L. Taylor, Cotton-end, near Bedford,—"Steam-engine controller."
—	3326	R. E. Branford, St. Leonards and Hastings,—"Daguerreotype accelerator.
—	3327	W. Dray & Co., Swan-lane, London Bridge,—"Lever and extended horse-rake.
—	3328	J. Symonds, Circus, Minories,—"Gold-washing cradle."
—	3329	J. Classon, Dublin,—"Steam boat and railway chessboard and men."
10th,	3330	J. Crawley, Silver-street, Cheapside,—"Arm-hole shirt front."
12th,	3331	J. R. Isaac, Liverpool,—"Perpetual remembrancer."
14th,	3332	G. P. Thomas, St. James's-street,—"Adjustable clog fastening."

DESIGNS FOR ARTICLES OF UTILITY.

Provisionally Registered from 3d June to 14th July, 1852.

June 3d,	424	H. Maling, Home-office,—"Projectile."
4th,	425	E. Mudd and T. B. Brown, Gravesend,—"Tent."
7th,	426	J. T. Hughes, Southampton,—"Ventilating water-proof garment."
8th,	427	F. P. Hampton, March, Cambridgeshire,—"The miner's succedaneum."
10th,	428	H. E. Campbell, Guildford street,—"Gold washing and dry sifting machine."
—	429	J. T. Cortin, Broad-street,—"Boot-tree."
15th,	430	W. D. Richmond, Birmingham.—"Anti-hydraulic gas slide."
—	431	H. Maling, Home-office,—"Projectile."
17th,	432	J. Boydell. Camden-town,—"Glass support."
—	433	D. S. Brown, Old Kent-road,—"Vessel."
18th,	434	T. Pope, Birmingham,—"Economic button."
21st,	435	J. S. Donaldson, Poland street,—"Expanding fire-grate."
—	436	G. Rottman & Co., Wood-street,—"Stereoscope."
22d,	437	Captain A. Collingridge, Brompton,—"Portable button for military purposes."
29th,	438	T. Pope, Birmingham,—"Press for embossing, raising, and piercing."
30th,	439	Captain A. Collingridge, South-street, Brompton,—"Shank for vests, shirts, and other buttons."
July 1st,	440	J. Schloss, Friday-street, City,—"Pick prevention key."
2d,	441	C. A. Collingridge, South-street, Brompton,—"Buttonhole for shirt-front and wrists."
14th,	442	Myers and Son, Newhall-street, Birmingham,—"Postage-stamp holder."

TO READERS AND CORRESPONDENTS.

RECEIVED—"Improvements in the Electric telegraph," by G. E. Dering, Esq.—"Description of an Inclined Plane, on the Monkland Canal," by J. Leslie, C.E.

J. B., BATH.—The notice was intended for another party. We regret that we have nothing further to say on the subject.

E. A. B.—The parts have been sent to Switzerland.

M. L.—A very good example of the arrangement he mentions, is that adopted by Mr. Hall in his "Oscillating Engines, with Link-valve Motion." See plates 6 and 8 of our first volume.

COLOUR-PRINTING—ITS HISTORY AND PRACTICE.

Printing in colours, as a manufacturing art, whether applied in internal house decoration by the paper-hanging producer, or for the ornamentation of the raw materials for ladies' dresses, so conspicuous in the windows of the retail dealers in such commodities, has far outrivalled every other branch of our national manufactures in the examples of applied science which it has involved. The teachings of the practical chemists of ancient and modern times have been ransacked to aid in the search after new tints, and to heighten the beauty, and add to the durability of those already discovered; whilst the accumulations of the mechanical science of ages have been devoted with lavish prodigality to the task of illuminating the woven cotton of America and the East with the loveliest combinations of these varied hues.

The interest which may be said naturally to attach to the subject is greatly enhanced, when we reflect that colour-printing does not affect so much the sumptuary conditions of mankind, as it is intimately connected with one of the great means of providing for the food and comfort of millions of our race.

The magnitude of the interests involved, as well as the effect of a repeal of oppressive duties, may be estimated by the fact, that in 1830, the year previous to such repeal, as to the one article, printed cottons, the entire production of the trade in England and Scotland, as shown by Parliamentary returns, amounted to 8,000,000 pieces, while in 1840 the production was doubled, and it is now estimated to be about 20,000,000 pieces.

As a supplement to the brief outline of the progress of calico-printing in its early stages in this country, given in our May part,* in connection with Mr. Jacobs' ingenious sixteen-colour or differential-action machine, we now add these pages, wherein we have entered more fully into the extended subject of colour-printing generally. The art of printing in colours, as far as appears from all the evidence within our reach, originated with the production of ornamented paper-hangings, or *papiers peints*, as they are more correctly termed by the French; and of this class of internal decoration, the earliest examples were printed in a single tint—what the modern calico-printer would call the "leading" colour, the other colours being filled in by hand. The Chinese have practised the art from time immemorial, the idea having been first imported into Europe by the English, where the heavy excise duty effectually stopped it. Paper-staining, as it is still termed, was carried on in France as long ago as 1586, but we are left to presume that in those days it was done by the "stencilling" process—an art much more ancient than the direct surface impression, or "printing" of colours, as we know that playing cards were stencilled at Nuremberg, the cradle of printing, previous to the year 1440. The earliest cut blocks for printing paper-hangings of which we have any record, were those of Francois of Rouen, in 1620; and in May, 1634, a patent was obtained in England by Jerome Lanyer for "flocking" various materials, just as is now practised; but the patent nowhere mentions paper as the fabric to be thus ornamented.

Beautiful hand-painted papers had been introduced at this time from India, in rare quantities; and printed hangings were evidently manufactured here previous to 1712, as in that year a duty of 1½d. per square yard was imposed for printing this class of goods. At the same time, the manufacturer was further weighted with a duty on paper—a severe drawback to the progress of the new art, but not sufficient to damp the ardour of British enterprise, as the sequel of our history will abundantly show. In 1754, Mr. Jackson of Battersea advertised, in the inflated language of the period, "Imitation statuettes, living portraitures of the gods, in *chiar oscura*, on paper;" and this business was further developed by Messrs. Tootell & Young, Boyle, Graves, Pickering, Hall, and others, and an extensive export trade was established with America, Spain, and other continental countries.

In 1786, George and Fredric Echard established a factory on a large scale at Chelsea, where the firm acquired great celebrity. In 1800, "flocking" was revived, after having lain by since 1780; and arabesque paper-hangings were manufactured with some degree of excellence by Mr. Sherringham of Marlborough Street—the printing being executed by two foreigners, named Lewis and Rosette, engaged for the purpose. The ignorant policy of the Government now doomed this branch of industry to still further restrictions; for, by the 24th George III., c. 41, the payment of an annual license of £20 was required by all who entered upon the business. Again, the 42d George III., c. 94 enacted that all paper-hangings "must be executed on first-class paper;" and these imposts, with the excise duty of 3d. per pound on the paper, and the 1½d. per square yard for printing, tended to raise the price so high, that the French easily outstripped us, driving us from the foreign market, and securing to themselves that field for improvement which has brought them to their present excellence. How widely different was the internal policy of the two rival nations! The English Government depressed the manufacturer, whilst the Government of France, a great agricultural country, encouraged hers by national expositions of their productions, and prizes for merit.

In the Parisian Exposition of 1802, or the tenth year of the Republic, only one paper-hanging manufacturer, M. Simon of Paris, exhibited. In 1806, the number was largely increased by exhibitors from Nancy, Strasburg, Rixheim, Besançon, Neustadt, Frankenthall, and Alsace. The valuable improvements in various pigments by M. Prior, a Parisian chemist, contributed very materially to the enhancement of the appearance of this class of goods, the paper for which, up to this period, was made in sheets—16 of which were pasted together to make a piece, 12 yards long, for the printer. Such pieces are still remembered by many concerned in the trade, and well they might, for the wear in printing, rolling, packing, and hanging, rendered the numerous joints sad eyesores when "up." This serious defect led to an improvement by M. Didot of Paris, and our own countryman Mr. Donkin, the engineer; and in 1807, Fourdrinier obtained his patent for a process whereby paper could be made at any reasonable width and endless length. The extraordinary mechanism introduced for this manufacture proved indeed to be, to the colour printer, what the power-loom was to the printer of calicoes—an inexhaustible supplier of the raw fabric. During these times, the cheap process of stencilling walls through paper patterns was introduced, and had a great run, but its great inferiority to printing caused it gradually to die out; although that it is yet in actual practice on a small scale, is evidenced by the existence in Manchester and elsewhere, of signboards inscribed, "A. B., Slapdasher and Stenciller." The repeal of the tax on printing, and the reduction of the paper duty, have now so far opened up the trade, that, at the time we write, the reader may purchase paper-hangings at full 60 per cent. less than the mere repealed tax of 1½d. per yard.

Looking back at all the drawbacks experienced by the English manufacturer, in the face of the great encouragement afforded to the French, we need not be at all surprised at their surpassing us in beauty and excellence. In 1827, Paris alone contained 72 extensive manufacturers, employing 4,200 persons, and the white paper which they worked up was valued at 4,840,000 francs, and the colour at 2,315,300 francs, the annual export being entered at 850,000 francs. The trade now received considerable advancement from the improvements made by M. Maber in designing; and in 1831, it was further aided by the introduction of cylinder printing by M. Zuber of Rixheim, the cost of production being thus reduced one half. M. Zuber also introduced a process of blending tints, adding greatly to the beauty of the patterns. In 1834, this gentleman employed 200 work-people, and turned out 300,000 pieces annually. M. Delicourt, who has acquired great fame for panelled papers, commenced the manufacture in 1835, and obtained the gold medal in the exhibition of 1844. This art is a field capable of exercising a very high order of ingenuity, as it contributes equally with calico-printing to affect the public taste. Many of our readers will remember the tapestry-like picture in the Great Exhibition, sent by M. Delicourt. It represented a chase in a forest, surrounded by a rich ornamental frame, with pilasters containing animals, birds, and attributes of the chase. We are informed that no less than twelve thousand blocks were required to execute this, as called by the jury, "most creditable work," and the exhibitor and manufacturer was rewarded with a Council medal. The credit due to him may be measured by his success. Immense quantities of paper-hangings are now imported into this country, and they are justly esteemed for their excellence of design and richness of colouring. In late years we have had quite a new style sent over to us. This consists of large landscapes, sufficient to cover the whole interior of a small room, or one side of a large one, for which indeed they are more especially intended. Such of this class as we have examined closely are not "prints," being cut in lengths, with the left edge sharply creased where it had been folded down to form a margin to join over, the other margin appearing to have been fastened against a wall or canvas screen, and designed and finished by the joint efforts of the pencil and brush. The superiority of the French hangings, in comparison with ours, is universally admitted, as well in design and colouring as, we may presume, in cutting, or otherwise finishing the printing surfaces; for defect in the latter process would sadly impair the design. The English manufacturer, with un-

* Page 32, Vol. V., *ante*.

blushing candour, pleads guilty to the charge of wholesale piracy from the French, urging in extenuation the great lack of native artistic skill. This being the case, it is evident that the unskilful artist, in manufacturing a sketch from morsels of French designs, will only make a half-and-half sort of affair; and, indeed, most of these, our patched up patterns, are but sorry caricatures after all. As a matter of course, the French take the lead; and when the defects in the English article are pointed out in the market, we are told that the retailers have no conception of the beautiful. Whether this extends through the wholesale trade to the manufacturers, we are not informed, but it is openly enough stated that the public is in this state of blissful ignorance. From all this we may infer, that the "trade" generally, knowing the state of their customers, do not care to attempt any really high degree of excellence; the first and indeed only question that forces itself upon their consideration, in selecting designs, being "will it take"—"will it sell?" Such a state of things cannot last for ever. The public taste continually improves, and the lead taken by the French, in keeping on the top of the wave of increasing excellence, deserves the success which it undoubtedly commands. Let us utter no sweeping condemnations. It is pleasant to recognise the steady advances which are being made by the firms of Messrs. Hinchcliff, Mr. Simpson, Mr. Woollams, Messrs. Townsend, Horne, Norwood, and others, of London; also Messrs. Potter, and Messrs. Heywood, of Manchester. Messrs. Potter have at work a fifteen-colour machine, made by Mr. Houston, a Manchester printing-machine maker of repute; and Messrs. Heywood have a fourteen-colour one. The energy and enterprise of these firms induce a hope that we may shortly break from the leading-strings of the French, and take our place in this branch as we have done in others, in the van of the markets of the world.

CALICO-PRINTING.

Twin sister art to paper decoration, is calico-printing. Springing into existence about the same time, and apparently from the same source—encountering similar difficulties, with obstructions of even greater perversity, it has yet grown up still nearer to perfection, and to importance immeasurably superior, as well in its own home market as in the bazaars of the whole world.

Although an evident afterthought, consequent upon the introduction of paper decoration, the two manufactures are in most respects widely different. Paper is coloured by a simple surface impression of a body pigment, whilst calico is, in most cases, chemically tinted, its fibres or threads being actually dyed.

The "Annals of Manchester" tell us that calico-printing was first introduced into England in 1690, and the advent of the art was hailed as one of the advantages gained by the revocation of the Edict of Nantes by Louis XIV., in 1685.

The first *mousseline* and *chintz* prints of London manufacture, like paper-hangings, were printed in outline with one colour only, the finish with the other tints being accomplished by hand-brush painting. But here the English printer was met by the Act of 1720, putting a stop to the wear of "printed calicoes;" and not until the lapse of several years was he released from his more severe burdens, and permitted to follow in the wake of the French, who, untrammelled by any such restrictions, had all along held on their course unchecked. The name of Koechlin, so well known amongst the foreign printers of the present day, is creditably associated with the subject of our history at a very early date; for we find that Samuel Koechlin was the first to establish print-works in Mülhausen, on the *Haut Rhin*, where his descendant, Andreas Koechlin, is still located. This was in 1746. The first Lancashire print-works were commenced by the Messrs. Clayton at Bamber-Bridge, near Preston, in 1764; and the second, in 1770, were established by the founders of the great Peel family. William Peel, father of the first Sir Robert Peel, who afterwards became a banker in Manchester, and died worth two millions, and grandfather of the late illustrious Premier, was the projector in this instance. The works were at Brookside, on the right of the road from Blackburn to Accrington, and about two miles from the former place; but he was compelled to remove from this place by the severities of the mob law of that day. After getting his house ransacked, and his printing machinery broken, he went to Church, a hamlet, a mile from Brookside; and at a later period, the Messrs. Peel started works at Sawley, near Clitheroe, at Burnley, and at Foxhill Bank—the business being subsequently spread over the country to Sabden, Sunnyside, Oakenshaw, Primrose, and Broad Oaks, by pupils from the Church works.* It was not until 1774 that an act was passed to *legalise* the calico-printing art. The legalization of a commercial pursuit would sound strangely enough in our times, and yet an act was required for the purpose in 1774, bringing with it the comfortable adjunct of a duty on "printed, painted, and stained cotton." The art now began to grow up into commercial importance, and, in 1777, what was considered a great step was made by Mr. R. Williams of Manchester, in his invention of a green dye for cotton. Then came cylinder printing, traditionally said to have been invented by Oberskampf, at Jouy, in France, but we believe independently conceived in 1785 by Mr. Bell, a Scotchman, and first practised on a large scale by the Messrs. Livesey, at Mounsey, near Preston. In 1787, the legislature passed "an act to encourage the art of designing original patterns for prints," and about the same time the Messrs. Peel gave another assistant to the workshop, by their introduction, at Warrington, of the then infant steam-engine for driving cotton factories. This was followed, in 1788, by Mr. Henry's invention of the art of bleaching by oxymuriatic acid. In 1792, the firm of Fort, Taylor, & Bury, was established at Broad Oaks, Sunnyside, Oakenshaw, and Sabden, and afterwards changed to Fort, Hargreaves, & Co., Taylor quitting the concern. This partnership, forming the groundwork of some of the most eminent firms of modern printers, was dissolved in 1811, Mr. Fort taking Sunnyside, and Mr. Bury, Sabden, whilst Messrs. Hargreaves & Dugdale recommenced at Broad Oaks in 1812. Compared with their existing extent, these works were at that time on a very small scale. The now celebrated works of Broad Oaks, for instance, boasted of only six small buildings, some of them sheds, and altogether covering an acre of ground. They are situated in a picturesque vale, on the banks of a clear rapid stream, above the town of Accrington. Amongst other printing firms of more than ordinary importance and extent, are to be reckoned that of Thomas Hoyle & Sons, whose works are at Mayfield, in a dense part of Manchester, on the banks of the winding Medlock, and to the left of the London road. These works were established when the locality was a May field indeed, and the Medlock a pure trout stream. Now they exhibit a huge pile of buildings, all blocked in with little streets. On the opposite bank of the river are the works of Messrs. Leese, Kershaw, & Co., formerly in the possession of Thomas Duckworth. At Garrett, near the Oxford road, and watered by the same inky stream, are the works of Messrs. Ainsworth, Sykes, & Co., projected by Samuel Green; and at Rhodes, near Middleton, are the huge works of Messrs. Salis, Schwabe, & Co., formerly carried on by Daniel Burton.

But very few print-works, and those but of small extent, are established in Ireland. Twenty years ago there were several large ones in that country, but they have all been closed. This is somewhat to be surprised at, as she paid no duty on home consumption of printed cottons.

Of the Scotch houses, we may mention the firm of Messrs. Dalglish, Falconer, & Co., whose works, containing 26 machines, are close to the charming scenery of Campsie Glen, a few miles from Glasgow. Messrs. James Black & Co., an energetic firm of nearly equal extent, are located still more pleasantly near Loch Lomond, in the Vale of Leven; Messrs. Tod & Higginbotham, also turn out printed goods from raw cotton and colours, from the gates of their works on the Clyde, in the south-eastern suburbs of Glasgow; Messrs. Bartholomew, at Barrowfield; Messrs. Monteith; Mr. T. Boyd, an extensive cravat and handkerchief printer at Barrhead, half a dozen miles from Glasgow; Messrs. Inglis & Wakefield, at Busby; Messrs. Crum & Co., at Thornliebank; and Messrs. John Black & Co., at Milngavie—all a few miles from Glasgow, with many others of more or less note, contribute to the Scottish share of the trade.

Surface roller printing, unlike what we should have supposed, was a later invention than engraved cylinder printing. It was suggested, in 1805, by James Barton, an engraver of Mr. Peel's, at Church. Barton also introduced the "mule" machine, combining engraved metal cylinders and wooden rollers, or *intaglio* and *surface* work. Although the process of printing calico is precisely the same as that involved in the production of paper-hangings, yet, from the essentially different uses of the two fabrics, the management of the colours in the two cases is quite dissimilar—calicoes being, of necessity, subject to frequent washings, to remove the soils of wear, must be printed in "fast colours," or, in explanation of an ill-chosen term, colours that will bear the ordeal of the laundry. In the first stages of printing, colours were concocted at random, and great

* Mr. Gillies, a surveyor in Blackburn, has in his possession a small piece of printed calico, carefully folded in a scrap of paper, of ancient make, and having on the outside the following inscription:—"The block from which enclosed cloth was printed was the first ever cut by Robert Peel, Bart., when he and his brother Jonathan (now of Accrington House) were apprentices to Thomas Yates, of Moorgate Fold, Livesey, near Blackburn, with whom they were boarders." The pattern of the print is plain but pleasing, and the colours appear to be very good. The cloth is evenly woven, and of very firm texture.—Whilst we write, we hear of the inauguration of Mr. Noble's statue of the late Sir R. Peel at Tamworth, one of the many places which have thus acknowledged the worth and genius of the departed statesman. How glorious is the career of that family, which has given birth to men whose names are so illustrious in the annals of commerce and statesmanship!

losses were sustained from crude, unsystematic, and, consequently, fruitless experiments. Dalton did much to correct this state of waste and uncertainty in colours by the promulgation of his atomic theory, and the science of chemistry was now really called in to guide the practical colour-maker, adding, at the same time, to the catalogue of his colours. The style of work at this time was chiefly confined to single colour prints from surface blocks—dipped blues, Saxon-greens, neutrals, and Turkey-reds, to which may be added, the curious mechanical process of the Messrs. Monteith of Glasgow, for producing a white figure in dyed Turkey-reds, in imitation of bandanas, an important process, but extremely limited in practice. A chemical means of discharging the dye for the production of the figure was also discovered by M. Koechlin, and communicated to Mr. Thomson of Primrose, Messrs. Monteith of Glasgow, and Messrs. Hargreaves of Broad Oaks, on whose joint behalf it was patented in 1813. Patterns in Turkey-red "discharge" now took largely in the market, and the trade became important. About the same time, "steaming" prints was introduced by Mr. Niven, a Scotchman. His process consisted in rolling the fabric round a perforated cylinder, into the interior of which steam was admitted by a pipe at the end, and the vapour, in passing off, fixed several of the colours then in use, and thus was established a class of work, technically called "steam goods"—a most important class, in connection with the modern use of tin mordants, and now worked out by various kinds of apparatus.

The chemical system of bleaching by chlorine was introduced in 1816, effecting the reduction of the time required for this operation from three weeks to a few days, and "gas-singeing" now took the place of the heated metal plate system for removing loose fibres. Still the English printers were labouring under the extraordinary duty of threepence a yard, whilst their French rivals were all the time commanding substantial encouragement, and receiving the honorary distinctions which the enlightened policy of their government awarded them. In this way, the early French expositions lent valuable aid, by affording distinctive recognitions of the services of the more enterprising firms; such, for instance, as the silver medal carried off at the Parisian Exposition of 1806, by M. Dolfus Meig, of Mülhausen, a famed printer at the time we now write. This year also brought cylinder printing into the French establishments, and Weidmer de Jouey added a beautiful green to the printer's colours; these advances, with Daniel Koechlin's chemical discharge, as patented in this country, with several new colours which he had discovered, insured to Mülhausen a splendid standing in the subsequent exposition of 1819, obtaining for it four gold and two silver medals, Rouen also figuring conspicuously in a similar way.

The machines then used in England were chiefly single cylinders, printing single colours, *Britannias, China Blues, and Greens.* But in 1818, Mr. Steiner of Church, at that time the chemical superintendent at Messrs. Hargreaves' works, discovered an improvement in printing cochineal pink—"fixing" the colour. This was a discovery of the utmost value, and led to the deserved popularity of the colour. In 1821, the same firm, Messrs. Hargreaves, produced, for the well-known firm of Lyddiards of London, a new style of chintz, in *black and safflower*—a great novelty in its day.

Up to this time, the engraving of plates and copper rollers used for printing was of a very inferior class; but in 1822 it received considerable improvement at the hands of Mr. Potts, a painter, who wrought up this branch of art to a high state of perfection. Whatever improvement, however, had been made in the details of the process, would have been of slight avail but for the opportune introduction of the power-loom, which made the supply of raw cloth abundant and cheap. But with its assistance the trade became more and more important, extensive markets being opened up with America and Germany, the chief buyers of engraved patterns at that day. One of the more recent discoveries of M. Koechlin, was the fixing a bright yellow on cotton. After him, most of the English printers turned their attention to the subject, and Messrs. Hargreaves gained the credit of first effecting it here. A new style of printing was next produced by M. Spirling, a paper-hanging printer of Vienna, and by him communicated to the Mülhausen printers. It has since taken the name of "rainbowing," from its resemblance to the magnificent blending of the prismatic hues in

"The rainbow in the sky,"

a series of colours being arranged in parallel longitudinal lines, and harmoniously blended into each other at the edges. Many of our printers attempted this curious style, but it was abandoned by most of them as perfectly impracticable, after much loss of labour and material; but within an hour or two of its condemnation at Messrs. Hargreaves' works, Mr. Lightfoot, the chemist of the establishment, had the good fortune to succeed in it.* Since this period, various modes of rainbowing have been invented. M. Spirling's process was worked out by blocks, and this was followed by the adaptation of the same principle to rollers, the colours of the spectrum, or various shades of a colour, from the deepest up to mere water, being arranged in separate boxes, so that the roller, when charged with the colours in regular gradation, blends the edges of the several colour stripes, in laying them on the fabric. M. Depoully, of Paris, is also the inventor of a system of rainbowing by "dipping." The piece was folded back and forward longitudinally, according to the number of folds and rainbows required, and, when so folded, was dipped to greater or less depths in colours of one or more shades, so as to soften and blend the tints. This apparently crude process was successful in the hands of Mr. Auchterlonie, of the extensive Scotch firm of James Black & Co., who finally succeeded in conquering the almost insurmountable difficulties of the process, and worked it, so long as the "tyrant fashion" permitted, at the works of the firm at Alexandria, on the banks of the Leven, flowing from the foot of Loch Lomond. These successes were followed up by other firms, and the style for a time took the lead in the market, reviving the hand-block trade, to which it was confined. Throughout the varying phases of design, and the fickle passages of public taste, extending over a range of several years, some extraordinarily striking prints, such as allegorical subjects and commemorative scenes, have occasionally made their way in the market. The earliest of these attractions which had charms in our infant eyes was of the latter class, representing the seasons, in connection with rural life, and the occupations of the farm-yard. This covered our bed in several detached views printed in *bright red.* Here was the farm-steading—the "Dingley Dell" of the subject—planted beside a meandering brook in quaint perspective, with a hen and chickens being fed by a wee blooming lassie; there haycocks and haymakers, and yonder the reapers! And then the sheep-shearing! How we used to gaze on that big man pulling forward an unwilling sheep by its curled horns!

In the Paris Exposition of 1834, Mülhausen displayed its new light fabrics, of increased beauty in colour and design; and the firms of Koechlin, Dolfus Meig, Hausmann, Hartmann, and Schlumberger, were laden with blushing honours. Rouen also acquired an advanced position, in which the house of Barbet stood prominent. Amongst their productions, some mixed fabrics of cotton and wool, termed mousseline-de-laines, and light woollen prints, attracted great attention. The new de laine fabric was adopted by the English printers in 1836, and became a favourite in the market, as our readers must have experienced. The repeal of the reduced duty of threepence per yard gave new life to our printing trade; and great was the rejoicing amongst the printers consequent thereon. Many firms cracked bottles for their men, and "mugg'd" their boys. But this penalty for working had been kept on too long. France was fairly in occupation, doing a great export trade. Still the change was better late than never, and it must have added greatly to the thrift of the trade.

In the present day we find it generally stated by the proprietors of printworks, that the engraver's art, which had continued to improve up to 1836, has since that time gradually declined. New and expeditious modes of sinking the figures on the cylinders have been introduced. Etching, milling, or machine engraving is now much applied, as well as the renewal or touching up old engravings, millings, or etchings, by varnishing the surfaces, leaving the *intaglio* portions to be acted upon by dilute sulphuric acid, after the manner of etching; and when the engraver is legitimately employed, he has to work at a cheap rate, and therefore adopts a ready mode of executing his work by cutting punches of parts of the "repeats" of the pattern, and transferring their figures to the printing surface by the hammer or mallet, and merely finishing or trimming off with the graver. Well may the true art of the engraver have declined under the practical operation of these processes; and in a few years, an engraver, capable of the execution of a diversified pattern on a cylinder, will belong to a rare and curious species, as the rising "die-sinkers" may never be called upon to attempt the execution of any continuous subject. Engravers cannot be made by the summary process of cutting a die for a leaf or flower. The remedy is to be found in the improvement of our existing chemical and mechanical processes for ornamenting surfaces.

For design, in this branch as well as in that of paper-hangings, our printers are the very pupils of the French. It is the admitted rule to pick up French ideas, and to work with the aid of French genius. To design with our own is the exception; the plea of "lack of ability in the native designer" being re-echoed here. This practice reduces our professed designer to the rank of a mere copyist; but in this matter it may be submitted, that the public is not placed in a proper position for judging, one side only of the subject being set before it, namely, a printed copy of the original design. It is also to be borne in mind, that the

* Mr. Lightfoot has lately added to his reputation by the discovery of a means of fixing *archil lilac* on cotton. This is the leading colour at the present moment.

printers themselves equally complain of the decline of the engraver's art. May we not, then, reasonably presume that inferior execution of the engraving, etching, or milling, would produce but a faulty copy of the original? The silence of the designers on this head must not be held as an acknowledgment of incapacity. They may have nothing to gain, and much to lose, by entering into the contest.

In the course of a conversation which we had some years ago with a designer to calico-printers, we mentioned this *small* matter of piracy from the French, and he at once admitted that it was the regular practice, adding, that the printers would not purchase designs until after the receipt of the periodical French supply; in fact, that they were so accustomed to patterns made up from pieces copied from the French, that they would not purchase any offered as English originals; but that he had, on some occasions, passed off as copies from the French, designs purely his own. If this is true, it would appear to be the force of habit that maintains this "picking" system. Or, is it cheaper to continue it than to hire real talent; for who can doubt that French designers are to be hired by British gold? If the firms of Mülhausen and Rouen can afford to pay talented men, surely the like can be done by the gigantic establishments of Manchester and Glasgow; and they must do it, if they are to maintain their position in this age of competition and free trade. For our own part, a comparison of specimens of the finer class of prints, shown us by one or two firms, as executed when the art of engraving was at its height of perfection, with the prints now produced, leads us to the conclusion that the pointed difference in finish is not altogether attributable to the imperfections of the engravings, for we have observed that most of the early fine line engravings were printed in one colour, so that the impression had full time to dry before it was again touched; whereas the many-coloured prints now produced, by printing with engraved cylinders, where each colour, immediately on being impressed upon the cloth, comes in contact with the blank surfaces of succeeding cylinders, are spoiled by the pressure spreading the colour beyond the bounds of the pattern; and, however sharp the outline, or however fine the finish of the engraving, the print will be more or less impaired.* A great portion of the colour is, indeed, forced through into the "backing" cloth, which travels along with the blanket cylinder, beneath the fabric, so that this backing also gets an imperfect impression of the figure, of course requiring washing out. Now, this defect may be readily remedied with economy to the printer; for it must be clear, that if only one engraved cylinder is used for putting in the finer lines, or the general leading outline, the following colours making up the brilliancy of the piece, being put in by surface rollers, the finish of the engraving will be maintained unimpaired in the print, as its lines will pass through the machine beneath the intaglio portions of the surface rollers, whilst they are printing their own individual contributions to the pattern. And, with clean, sharp cut surfaces, a better finished print may be produced than can possibly be effected in several colours by engraved cylinders.† By such means, the public would have fair specimens of the joint powers of the graver and printing machine. It is for carrying out this principle to a high state of perfection, with a great variety of tints and shades, put in after the manner of the artist, by a touch here and a touch there, to give effect to the print, that Mr. Jacobs' system‡ has been introduced. By it a two colour machine is capable of printing from two to six colours as required. Indeed, from one cylinder a perfect pattern in three colours may be printed, one of the colours occupying the whole circle of the cylinder. A three colour machine would serve for better goods of the present style, as it would print any number from three to seven colours due to the design. In addition to the illustrations of Mr. Jacobs' plans, which we have already given, he has proposed an arrangement for printing any number of colours side by side, either distinct or blended, so as to render the colouring powers of his machine almost unlimited. The accompanying engravings illustrate his plan of type printing. In laying this down, he started with a theory which may be termed a fundamental principle in ornamentation—that all natural objects and artistic productions are made up of portions of circles, angles, and straight lines; and how he has worked out his meaning we shall now proceed to show.

Fig. 1 is a plan of a table of straight lines, angles, and small circles. The figures, A, are squares, following the body of the types, serving to make up large ornaments, just as the letter-press printer inserts his "spaces" where blanks occur in his copy. The portions, B, are straight lines; and C, D, E, and F, are corner types forming the square; G, H, I, J, K, L, are filling-up types; M, N, O, P, are terminations and fill-ups; and 1 to 10 are angles.

Fig. 1.

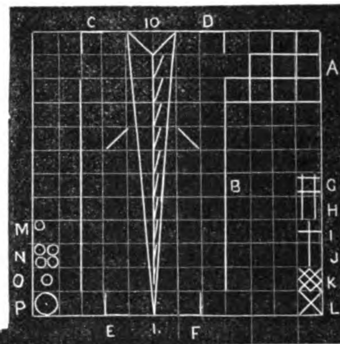


Fig. 2, is a table of circles of various sizes, and in various relations to the square body of the type and the plane thereof, plain and shaded in different directions. The lines, A, B, are plain circles; C, D, lines shaded from centre; E, circles started at the points of intersection of the types, and drawn through the centre of the square; F, started in the centre of a type, and drawn through the centres. The great circles are all started at the point of intersection of the square types, and drawn through the edge of the types. At G, are $\frac{1}{16}$th types to correspond.

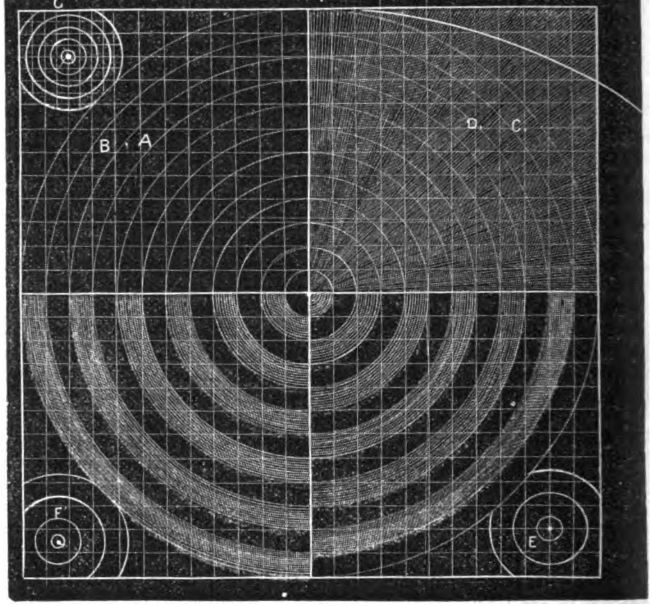
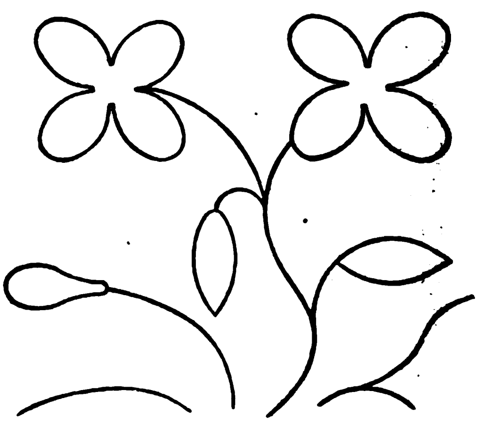


Fig. 2.

Fig. 3 is a figure in outline, printed from the types, A, B, cut in a lathe. They may be wholly formed in the lathe, or beneath a small upright drill, the the squares and angles being executed rapidly and accurately in a small planing machine, either sunk, for engraved work, or left up, for surface work, as in letter-press; and Mr. Jacobs states, that 1,000 types, or the dies to cast from, may be made in less time than a single letter of the common types; and that they may be

Fig. 3.



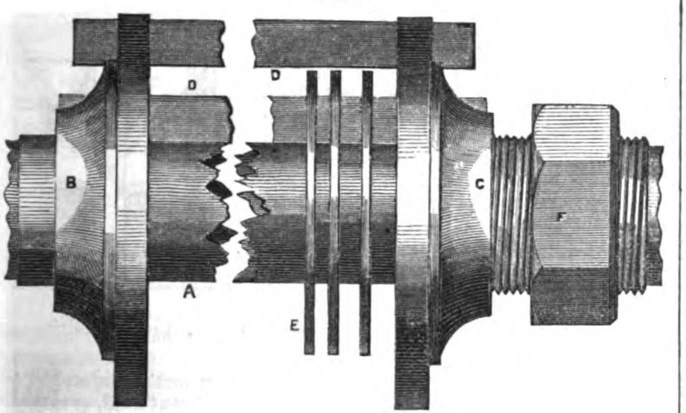
* At Messrs. Hoyles we were shown the pattern-book by the managing partner, who dilated upon the well-finished engravings of earlier times. These were single colours, overloaded with foliage and ornamental scroll work. Any one who examines a collection of prints dating from thirty or forty years back, will at once see the difference in respect of outline, the earlier examples being much the sharpest: but, for the reasons already given, we are of opinion that the Manchester printers, who gave all the blame to the engraver in their evidence before the Parliamentary commission of inquiry, were most egregiously in error. In those days the engraver ruled the effect; now it is very different, for the effect (of the multitudinous cylinders) rules the engraver.

† The best specimens in the late Exhibition were "surface work"—hand block printing.

‡ See his sixteen-colour machine formed out of a six colour.—Plate 98, *Practical Mechanic's Journal* for May last.

used by the letter-press as well as the calico and paper-hanging printer.

Fig. 4.



The circular types will count from the centre 1, *c c*; 2, *c c*; 1, R *c*; 1, L *c*, &c.; *c* signifying circle, and R, L, right or left, denoting their

Fig. 5.

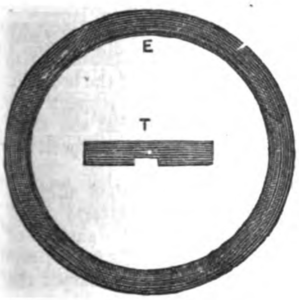
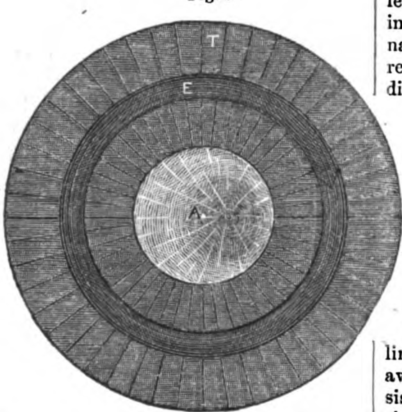


Fig. 6.



relation to the plane line, as is necessary in cylinder work. Figs. 4, 5, and 6, represent the plan of making up a printing cylinder in moveable types, either for letter-press or ornament. The shaft, A, has upon it a fast collar, B, the opposite collar, C, being moveable. D, are margin bars, to be used when required, and E are annular keys set ready for use. The printer commences to lay his radial types on the collar, B, as shown in the transverse section, fig. 6, holding them down with the ring key, fig. 5, which enters the notch in the side of the type, T, here placed inside the ring to save room. When the subject is "set up," the nut, F, is screwed down to bear against the loose collar, and hold the component parts firmly together. During this adjustment, the types are kept true to the circle by rolling the whole upon a level table.

In our recent paper on this subject,* we have said that the ultimatum of colours in the common cylinder machines was eight. This is hardly correct, although the number of machines at present in use working more than eight colours is exceedingly limited. Indeed, it is only very lately that ten colours have been worked; but Mr. Bazley, in his lecture at the Society of Arts, mentions the existence of a twelve-colour machine.

Amongst the more eminent makers of this class of machinery, in addition to Mr. Houston, we must include the name of Mr. Gadd, of Salford, who made the first eight-colour machine ever used. Mr. Gadd is at present constructing two twelve-colour machines for Messrs. James Black & Co., of Glasgow. Messrs. Mather, of Salford, the makers of the eight-colour Exhibition machine, who are fitting up two twelve-colour machines for a Glasgow house, and Messrs. Holliday, of Glasgow, who have also made machines for large combinations of colour, are makers of standing. We shall probably be able hereafter to illustrate more fully the existing and progressive condition of calico-printing mechanism, by the publication of selections from their works.

*** Page 33 for May last.**

REMARKS ON SOME PROPERTIES OF THE SCREW PROPELLER.

If the screw propeller were working in a rigid and unyielding medium, as when an ordinary screw works through a fixed nut, its diameter would be a consideration, having reference only to the strength required to sustain the torsional force of the engine, and it would be independent also of the projection of the threads from the axis, beyond what is necessary to provide for wear, and to avoid the additional friction that would be the result of insufficient surface. But when we come to consider the condition of a screw working in water, it will be found that the yielding character of that medium will make a great difference in the proportions necessary to be observed in it as a propeller.

Some of the following explanations may seem superfluous, as the matters explained are self-evident enough to persons acquainted with the subject; but we have reason to believe that they will still be acceptable to many others.

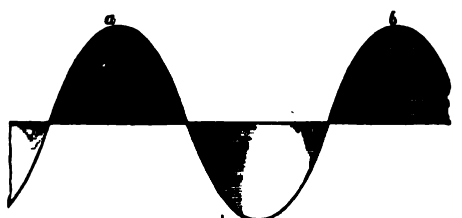
The first screws were made with two half-turns of the thread, placed opposite to each other on the shaft, forming a portion of a double-threaded screw, and consequently, when viewed in the line of the shaft, the blades presented the appearance of a circular disc. This proportion was, no doubt, adopted under the supposition—natural enough—that the complete circle would give a greater area of propelling surface than any smaller portion, and consequently there would be the least slip with it.

The area of the disc could not be increased by any addition to the length of the propeller; so, in trying further experiments, as we are informed by Mr. Lloyd's evidence in the case of Lowe *v.* Penn, the natural course would be to try whether the effect would be altered by reducing the length, which would necessarily also reduce the area of the disc, by cutting out sectors from the circle. The area of blade so obtained was successively reduced, by further cutting from the length, with an accession of effect at each reduction, until the proportion of $\frac{1}{6}$th of the circle was reached, and at which point, or within small limits either way, the greatest effect was attained. This proportion has been adhered to in designing screws for the vessels subsequently built, and the experience with them has confirmed the correctness of the experiments with the *Rattler*. It is now proposed to consider what effect is produced upon the value of the screw as a propeller, by the various proportions that may be given to the area of its blades, as this is affected by the length, pitch, and diameter.

By "length" is understood the space occupied by the propeller in the line of shafting, or of the keel, the blades being supposed not to be cut away on the edges, either at the outside or near the centre, but to consist of a section of a true screw, made by two planes cutting the axis at right angles, as in fig. 2. **The blades, when viewed endways, or in the line of shaft, will therefore present a pair of sectors, with straight radial edges, as in fig. 12.**

By "pitch" is meant the distance measured in the axial line or plane, described by the thread or blade of the screw during one convolution, as in fig. 1, *a* to *b*, and it is therefore the measure of the distance which the screw would advance, if working in a solid unyielding nut; and it is quite unaffected by the reduction of the

Fig. 1.



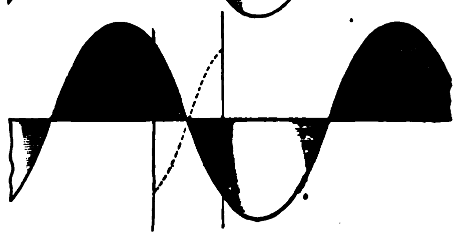
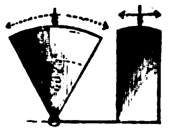


Fig. 2.

length of the screw below one complete turn, which is made when it is used as a propeller, as in fig. 2. As, during one revolution, the axial advance due to the pitch, and the circular motion round the axis, are both completed in the same time, it follows that any given part of the one will be completed in the same time with any equal fractional part of the other. That is, if the radial edges of the blade include $\frac{1}{4}$th of the circle, they will also, in the axial plane, include $\frac{1}{4}$th of the pitch, as in fig. 3. From this the pitch of a given propeller may readily be found, by first finding what fractional part of the circle is included between the radial edges of

the blade, and then multiplying the length of the propeller by the denominator of this fraction.

Fig. 3.



When the propeller revolves, the resistance of the water is of course at right angles to its surface, *a b*, fig. 4; and by the resolution of forces, this may be separated into its components, one at right angles to the shaft, *a c*, and the other parallel to it, *b c*. The intensities of these resistances are relatively expressed by the lengths of the lines respectively representing them. The resistance, which is at right angles to the keel, is evidently of no service in propelling. That which is parallel to the keel is useful in propelling the ship, and the other constitutes the resistance to the engine. It may seem paradoxical, that the force employed in propelling the ship should be in a direction at right angles to that of the force of the engine; but it will be made apparent in a simple manner, by considering the extreme case of the pitch of the screw being increased to infinity in relation to its diameter. The blade would then be in a plane parallel to the axis, fig. 5, and it is clear that the whole power of the engine would be employed in turning it round, without producing any propelling effect at all. On the other hand, if the pitch of the screw were reduced to nothing, the blade would become a flat plate, set in a plane at right angles to the axis, fig. 6, and the resistance to the engine and the propelling force would alike be *nil*. There is, therefore, a limit to the useful reduction of the pitch, which is to be found by experiment; and the result so found is, that the pitch should not materially exceed the diameter, but may be rather less, in cases where the consequent greater number of revolutions is not inconvenient.

Fig 4.

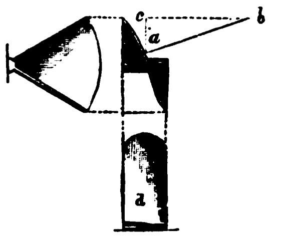
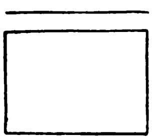
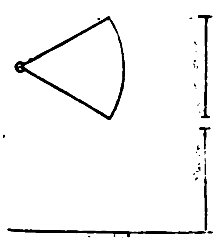


Fig. 5.



Theoretically, a coarse and a fine pitch would have an equally good action in propelling, since the screw in either case must advance in proportion to its pitch; and it is found in practice, that, within moderate limits, the angle of the blade is but of small importance in regard to slip.

Fig. 6.

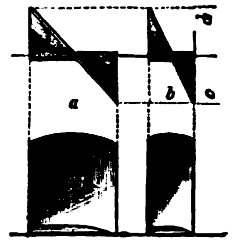


It appears then that the forces acting or reacting on the screw propeller are divisible into two distinct parts—one, resistance to the engine, and the other, propelling effect, which may be called axial resistance. To reduce the former, without impairing the latter, is a desirable object, since by so doing we reduce the power to be demanded from the engine. Now this is the principal secret of the advantage found by reducing the pitch, which has the direct effect of shortening the screw, whilst it leaves the area of the disc—considered through one revolution—unimpaired. It is necessary to remark, that the area of the disc of the screw, which is that concerned in axial resistance, is to be estimated in all cases as the whole circle described during one revolution, notwithstanding that the blade itself may be only a small sector; for the action of this sector, or of any elementary radial line forming a part of it, is repeated successively through every degree of the circle, and at the end of one revolution has passed over the whole of it; and this would only be the case if the blade consisted of half or a whole convolution, for each unit of the surface would only have described one circle, and only one circle in either case would be, as it were, cut out in the water.

The area presented by the propeller blade, when viewed laterally, as at *d*, fig. 4, which is that concerned in resistance to the engine, may be called lateral area, and is an element of great importance; as the resistance to the engine consists of the reactive force of the water against this area, and the velocity with which it is encountered, so the axial resistance consists, in the same manner, of the reactive force of the water against the disc, and the velocity with which the disc moves, axially, in virtue of the pitch.

It will be seen from what has been stated, assuming all pitches to be equally effective as to slip, and also assuming that the same portion of a whole turn is used, say ⅙th, that to reduce the pitch, at the same time reduces the lateral area, whilst the disc area remains unaltered. In fig. 7, *a* is the coarse-pitched screw, *b* the finer one. The space from *c* to *d* in each is ⅙th the circumference, and is the same in each. The consequence of this is, that the engine is enabled to make more revolutions, which, as long as the boilers will supply steam, is tantamount to an increase of power, and the result is that the ship goes faster. It is also proved by an experiment such as this, that the disc area of the screw is really that of the whole described circle, and is not dependent on the lateral area of the blade, as measured in its own spiral direction, which is an element frequently made much of by writers on the screw, but has practically very little to do with its effective action. For in the experiments with fine and coarse pitched screws, the fine pitch has had rather less slip of the two, though having also less lateral area. It is probably also due to too much attention having been paid to this element, that the very common error has been committed, of making propellers too small in diameter, which has a very serious effect on their usefulness, as we shall now attempt to explain.

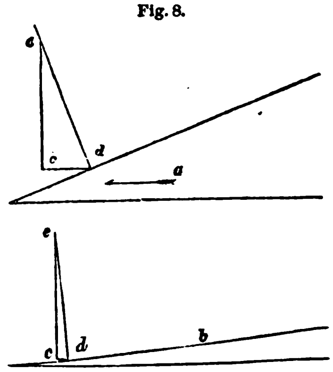
Fig. 7.



The effect of any kind of propeller in producing motion in a ship, is mainly due to its action on the water being of a different kind, or rather, perhaps, from its being modified in a different manner from the resistance experienced by the body of the ship. The measure of the direct resistance to a ship is, as everybody knows, the area of the midship section. But in two ships of similar midship sectional area, the speed of the one may be variously greater than that of the other, on account of the difference in the forms of their bows, and also the difference in their length. Thus, to take the latter circumstance first, suppose a ship of any section, and prismatic in form—that is, of similar section, and the sides parallel throughout the length, with ends cut off square, and with a length of 6 to 1 of the breadth. A paddle-float fitted to her, say 10 feet long and 2 inches thick, will have—changing the names of these dimensions to compare with those of the ship—a length of only 1 to 60 of the breadth. These proportions will have such an effect on the resistances respectively opposed to the bodies, viz., the ship and the paddle-float, that the ship, though of greater section than the area of the paddles, will experience the lesser resistance, and will consequently move forward.

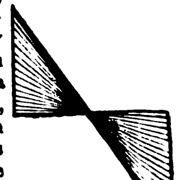
The better effect of the sharp bow is due to the diminished angle at which it meets the water, which has to be displaced in a lateral direction. For as the line of resistance is at right angles to the surface of the bow—and this may be taken as the resultant of two forces, one parallel to the keel, and the other at right angles to it—the sharper the bow, the smaller does the lateral part of the resistance become. In fig. 8, *a*, the wider bow; *b*, the sharp one; *c d*, the measure of resistance in the line of motion; *c e*, that of the lateral resistance, which is made constant, for the purpose of comparison with *c d*.

Fig. 8.



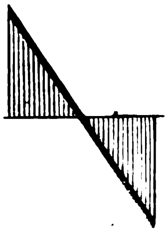
The angle of the blade, which is always measured from a transverse plane, decreases as the blade recedes from the centre, fig. 9, as a necessary result of the varying proportion the pitch bears to the diameter, at different points between the centre and the circumference; for as the blade is an inclined *plane*, every radial line drawn on which is at right angles to the axis, fig. 10, every portion of it must have the same pitch. Now, two screws of different diameters, but of the same pitch, would have different angles; to simplify which idea, let them be imagined to be mere lines drawn on the surfaces of cylinders, fig. 11, since in the smaller, the spiral line has to describe a smaller distance circumferentially, in order to reach a point equally distant axially, and will therefore take a direction more nearly parallel to the axis, that is, making a greater angle with a transverse line. In fig. 11, *a* to *b* = pitch; *c d*, transverse line from which angles are measured. It is obvious that two points at different radial distances in the same screw, are in the same relation to each other in regard to angle, as the two separate screws we have just been considering; from which our statement will be proved, that the angle varies with the radius at any given point in the blade.

Fig. 9.



Recurring now to our former resolution of the forces acting on the screw blade, it will be seen that the ratio between the lateral and axial forces is entirely dependent on the angle of the blade, exactly in the same manner as in the analogous case of the bow of the ship; that is, the sharper this angle is made, the less resistance the screw meets with in the lateral direction, thus relieving the engine of some load in addition to that already explained to have been taken off by reducing the lateral area. Both the lateral area and the angle are reduced by fining the pitch; for as the angle has been shown to be increased by reducing the diameter with the same pitch, that is, by increasing the ratio of diameter to pitch, it follows that, by decreasing the pitch, which is the same thing as reducing this ratio, the angle is reduced.

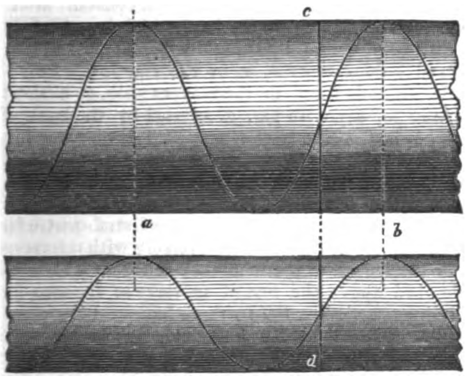
Fig. 10.



The disc area is that which corresponds with that of the paddle-float in our former comparison, and its propelling power, within the limits of effective proportion of pitch to diameter varies in the same manner with its area (breadth), and its thickness (length) in the line of keel.

To recapitulate:—1st. The reactive force of the water is exerted in a direction at right angles to the surface of the blade.

Fig. 11.



2d. This force is the resultant of two, one being in the line of keel, or of the axis, and it constitutes the propelling or *axial* force; the other is at right angles to the axis, and constitutes the resistance to the engine, or lateral force.

3d. The area of the screw is, in reference to axial force, that of the circle it describes, *a*, fig. 12; and in reference to lateral force, that of the parallelogram enclosed between the edges of the blade, viewed laterally, *b*, fig. 12.

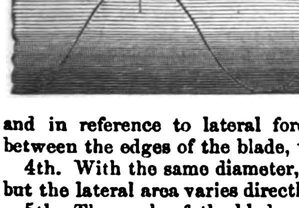
4th. With the same diameter, the disc area is the same for all pitches, but the lateral area varies directly with the pitch.

5th. The angle of the blade, with a transverse line, varies with the pitch, and inversely with the diameter.

6th. The angle of the blade has a very considerable influence over the ratio between the axial and lateral resistances to the engine, as this is given by the ratio between the lateral and axial areas.

In proportioning a screw to a ship, regard must be had to the power intended to be employed, from which may be formed an estimate of the speed likely to be obtained. It will then be necessary to give the disc a sufficient area in reference to the midship section, to get the speed without undue slip, and this is as necessary to be attended to as with the paddle-wheel. The power of a paddle-float has been explained to depend greatly on its dimensions compared with those of the ship, as to length in line of keel, and breadth. It is well known that it is of great importance to make the floats as thin (short) as possible, to avoid slip. But area is also of great importance, and accordingly we find, in the most successful examples of fast steamers, that the area of float is very great, in some cases equal to the midship section, thus giving the different water-dividing powers of the paddle and the bow the greatest possible contrast. The same reasoning holds good for the screw. Its disc area ought to bear as large a proportion to that of the midship section, as is observed in the case of the paddle.

Fig. 12.



To this it may appear an objection, that to enlarge the diameter of the screw will increase the lateral area, and absorb in power what is gained in area of disc. But it should be remembered, that as the diameter is increased in proportion to the pitch, the angle is lessened, so that the resistance to the engine will not be aggravated in more than a very small proportion of what is due to the simple increase of lateral area. And, fortunately for the screw, the fine pitch which will be the result of a large diameter with a small angle, is also the best for propelling, in reference to slip. Where great speed is required, and consequently a very large diameter given, the length may be advantageously reduced below one-sixth pitch, to reduce the lateral area.

The lateral resistance is so much independent of the axial resistance, that when the vessel is prevented from moving by any external cause, such as being moored, the engines will make nearly as many revolutions as when going at full speed; while a paddle-wheel, in which the direct resistance to the engine is in the same direction as that of the propelling force, will, under similar circumstances, not make more than one-fourth to one-third of the number of revolutions at full speed. The effect produced by an extra load in towing, or by the resistance of a strong head-wind and sea, is respectively similar. The practical effect of this peculiarity is, that in the cases above supposed, the screw enables its engine to exert much more power than the paddle-wheel, which has been abundantly proved by trials of vessels lashed stern to stern, one screw and the other paddle, in which it has been always found that the screw towed the paddle; not in consequence of its slip being less, for it would be greater at such a time than that of the paddle, but from the screw engine being enabled to exert greater power, from the great number of revolutions, than its antagonist.

A screw that is found large enough to propel a vessel in smooth water, and under other favourable circumstances, may be very deficient when placed before any of the extra resistances above enumerated; and it is evident, that although the engines may be exerting great power, yet if this is dissipated in slip, we do not gain real benefit; on the contrary, waste of fuel is the direct result. The diameter should therefore always be made as large as the draft of water will allow, unless in cases, which will seldom happen now, when the power is unusually low. But at present, screws are generally expected to go not less than nine knots, even with auxiliary power; and with the power necessary to obtain this speed, it will always be found that the diameter of screw may be advantageously made equal, or nearly so, to the draft of water abaft. This will bring the top of the disc above water, but the increase in immersed area will more than compensate for this; and besides, there will be in most vessels, that is, in every vessel with any hollow in the after-part of the run, a wave that will cover the screw even with this diameter. It is not intended that this form and its attendant wave are advantageous, but this is a common form for a vessel's run, and is considered indispensable by many builders.

The *Water Lily* and *Fairy* offer a useful comparison of cases of large and small screws. The *Fairy's* midship section is 74·4 feet, and the diameter of screw (original) 5 feet 4 inches, which gives a ratio between the midship section and disc area of 3·2. The *Water Lily's* midship section is approximately 50 feet, and the diameter of screw 8 feet, which gives a ratio of 1·16. The tonnage of the *Fairy* is 312; of the *Water Lily*, 187: horse-powers, 128 and 50 respectively. The ratios between these elements are, for *Fairy*, 2·43; for *Water Lily*, 3·74, or that number of tons per horse. These comparisons are quite fair as to tonnage, since both vessels are of iron, and by the same builders, and their general forms are alike. It will be seen that the *Fairy* has a great advantage in respect of power, and is also a larger vessel altogether than the *Water Lily;* yet the speed of the latter was within half-a-mile of the former, if not nearer still; indeed, on one occasion she beat the *Fairy.* The *Water Lily* has also a much greater pitch than the *Fairy*, only 90 revolutions per minute being made by the screw, whilst the *Fairy's* went at the rate of 258, but the length of the *Water Lily's* screw was much below one-sixth the pitch, so that its lateral area was not great. It projected considerably above the water.

In an experiment tried at sea, and recorded in the *Practical Mechanic's Journal*, between her Majesty's ships *Arrogant* and *Dauntless*, the benefit of a fine pitch was forcibly shown. The weather was rough, with a strong head-wind and a considerable sea. Both vessels exerted their full power, and the speed obtained was in the *Arrogant*, 3·8 knots; *Dauntless*, 4·1. Their dimensions are as follow:—

	Arrogant.	Dauntless.
Tonnage per horse-power,	5·2	2·58
Horse-power per foot of midship section,	0·62	1·11
Midship section (ratio) to screw's disc,	3·07	3·09
Ratio of pitch to diameter,	0·96	1·22
Horse-power per ton of displacement,	0·147	0·257

The indicated power was nearly in the same proportion to the nominal power in both ships. Thus the *Arrogant* was enabled, principally by the superior proportions of her screw, to make as good headway, within 7·3 per cent., as the *Dauntless*, though the latter possessed nearly twice the power per ton of displacement, with a midship section smaller for

the displacement, although slightly larger (3·09 to 3·07) for the screw's disc area. A certain allowance must be made for the *Arrogant's* form being better than that of the *Dauntless*, in having a rising floor with greater breadth, whilst the *Dauntless* is narrow and flat, with about one-tenth less draft of water; but the *Dauntless's* run is much superior to the *Arrogant's*, though this again is not of great importance at such low speeds.

Many propellers have been made with pieces cut out of the edges of the blade at various points. The principal object of these designs has been to remove the lateral area of the part of the blade near the centre, the angle at that part being so great, that it is evidently of little or no use in propelling, and adds to the resistance to the engine. The advantage of cutting away the blade at this part is at least very doubtful, for sufficient strength must be provided to carry the outside portion of the blade; and if the edges are cut away, the remaining part must be made thicker, opposing a resistance to the flow of water from the ship, which ought to be as unrestricted as possible. At this part of the blade, too, the lateral resistance is not of great importance, for resistance to motion through water varies as the square of the velocity; whereas the velocity of the different parts of the blade varies only directly as the radius, so that the lateral resistance near the centre diminishes very rapidly as compared with that near the outside. The motion in the axial line, which is measured by the pitch, is, however, constant for all parts of the screw, and there is, therefore, some little propelling effect even from the central portions; and this, coupled with the more easy flow of the water aft, past a broad thin blade, points to the normal construction with straight edges as the best.

No mention has hitherto been made of negative slip. This means simply, the ship going faster than the screw. The occurrence of this phenomenon depends chiefly on the form of the after-body of the ship, which is a matter not included in our present inquiry. We may remark, however, that the fact that the speed of the engine is only slightly accelerated, when the ship is going by means of the sails as fast as the engine alone would propel her, or even faster, is to be accounted for by the resolution of forces we have endeavoured to explain. The circumstance of the water passing away rapidly past the screw, in lines parallel to the axis, evidently does not affect the lateral resistance and action of the blades. It affects the axial resistance and motion; but as in a fine-pitched screw this bears a small proportional velocity to that of the lateral motion, the speed of the engine is not greatly accelerated. And it is the case, that the finer pitched screws are much more constant in their number of revolutions under varying axial resistances than the coarser ones.

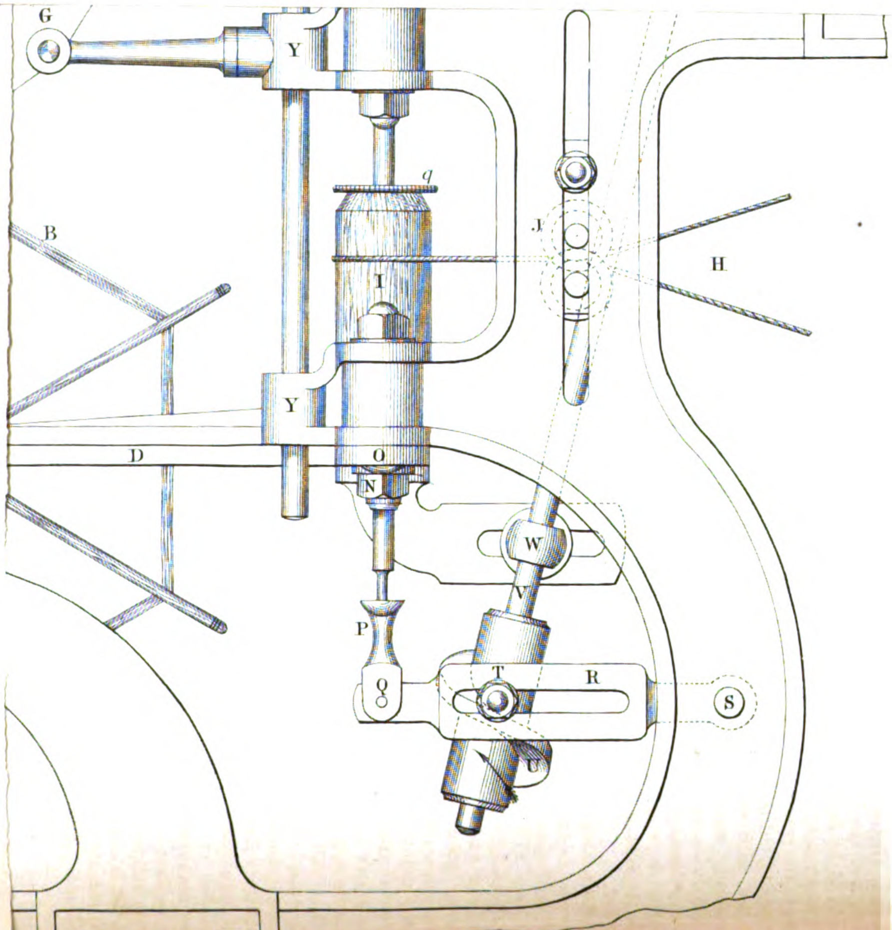
PATERSON'S SELF-REGULATING WINDING MACHINE.

(*Illustrated by Plate* 105.)

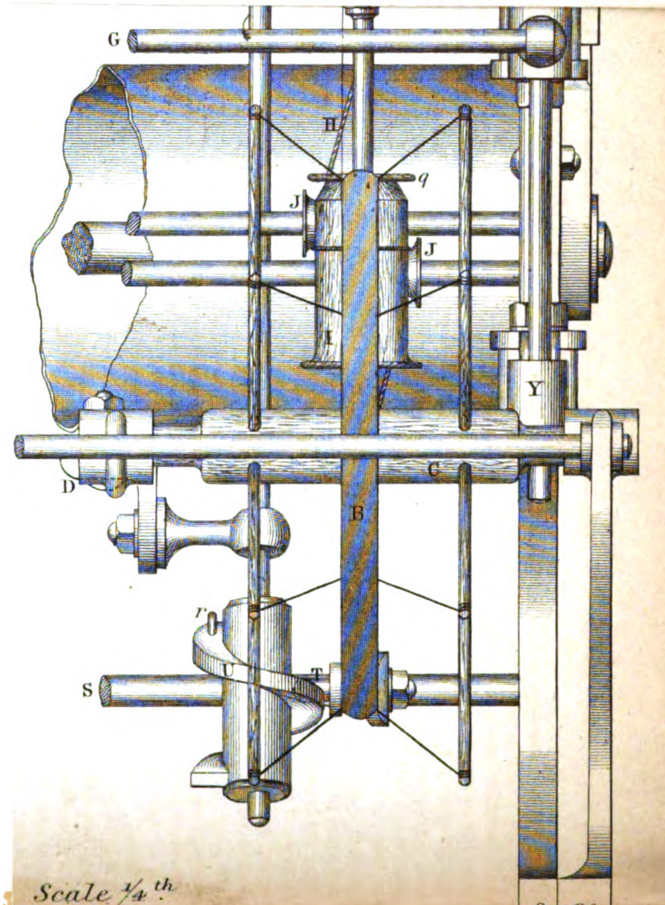
In the old "heart"-action winding machines, where a single heart or eccentric movement governs the vertical traverse of an entire range of spindles, for the "build" of the cop or bobbin, as the thread is wound on, the casual breakage of the thread necessarily leads to serious derangement in its laying-on; for the building movement goes on, whilst no yarn is passing. Again, in the more modern plan, where a fixed cone-pulley bears upon the coned layer of thread of the cop, each individual spindle has a separate action of its own; for the cone acts on each succeeding layer of yarn, so as to force the spindle itself gradually to descend against a counter-weight. Thus the build and winding-on movements are always in concert, for the spindle ceases to descend when the thread breaks. But the pressure of this cone not only slackens the layers of yarn, doing away with that compactness of the cop so essentially desirable, but its frictional contact also, in some degree, injures the actual threads. The patented invention of Mr. T. L. Paterson provides a remedy for all these objections; for it secures perfect uniformity of build, and, at the same time, prevents the objectionable waste and injury to the cop, so prevalent under the old system.

Figure 1, on our plate, is an external elevation of a portion of a winding-frame, as ordinarily constructed, for winding yarn or thread from the hank into the form of cops or pirns, but modified in accordance with Mr. Paterson's patented improvements. Fig. 2 is a corresponding front view of the machine, showing a single winding spindle only, the main framing and other details being broken away. The end standards, A, are connected by longitudinal tie-rods and frame-pieces in the usual way. The yarn or thread to be woven is placed in the hank form, B, upon the reels, C, the shafts of which revolve loosely in bearings, carried by the end and intermediate brackets, D E. Each of the winding spindles, F, is thus fitted with a separate reel, the thread passing up from it in the direction of the arrows, beneath the longitudinal guide-rod, G. The spindles receive their motion, in the usual manner, from a continuous driving drum, through the endless bands, H, working upon the long pulleys or warves, I, on the spindles, and guided by the small adjustable pulleys, J. The ordinary plain reciprocating traverse action for guiding the yarn during winding, is obtained by the common heart movement, in connection with a central chain pulley, the chain, K, from which passes over the guide-pulley, L, and is linked at its end to the long horizontal traverse-bar, M. With such a movement alone, the thread, being passed over this bar, would simply be laid on the spindles in regular, even, or barrelled layers; but to produce the necessary copping movement for building the yarn up into the pirn form, a compound movement must be produced, as in the mule. Each spindle has a vertical traverse movement in its collar bearings, N, in the fixed horizontal bars, O, its lower end resting in a cup or footstep, formed in the upper end of the short link, P. This link is hinged at Q, to the end of the slotted lever, R, working on a horizontal rod, S, as a fixed centre. The lever, R, carries, in its adjustable slot, a stud-pin, T, projecting out horizontally, and resting upon the scroll disc or worm of large pitch, U, fast near the lower extremity of the inclined shaft, V. In this way the spiral or scroll acts as the support of the winding spindle. The inclined shaft, V, is carried in two fixed stud-bearings, W, bolted to the framing, and it is the gradual intermittent revolution of this spindle by which the differential copping movement is produced. The alternating movement of the chain, K, which is linked to the horizontal traverse-bar, M, gives a constant alternate or reciprocating vertical movement to the bar, which is guided to work accurately in a vertical direction, by the guide-spindle, X, sliding longitudinally in the fixed guides or eyes, Y, of the framing. Corresponding to each spindle, there is fitted to the traverse-bar, M, a short oscillating lever, Z, working on a centre pin, *a*, carried by the back of the square piece of metal, *b*, fast on the traverse-bar. The piece, *b*, has also a fixed stop-pin, *c*, against which the short end of the oscillating lever, Z, rests when the machine is in action with the yarn unbroken, and another similar pin, *d*, upon which the longer lever arm falls when the yarn or thread gives way in winding. At *e*, is a fixed stud-centre for carrying the curved oscillating lever, *f*, placed transversely with reference to the line of spindles, or the length of the machine; the front end, *g*, of which lever projects forward above the line of traverse of the smaller lever, Z, already described, as carried by the traverse-bar. At the opposite end of the curved lever, *f*, is jointed a short detent, *h*, arranged to work into the ratchet-teeth of the small wheel, *i*, fast upon the tubular boss of the worm, *j*, working loosely on a fixed stud. This worm gears with the small worm-wheel, *k*, on the upper end of the inclined shaft, V. This worm-wheel is not fast upon the shaft, the connection being produced by stiff friction. A helical spring, *l*, abutting against a boss on the top of the shaft, presses on the top of the wheel, causing it to bear upon the shoulder of the shaft through an intervening leather washer. A handle, *m*, is fitted on the top of the shaft for turning, in trimming up or adjusting the height of the spindle. As an additional guide for the thread in being laid on the spindle, a short curved guide-arm, *n*, of porcelain, is carried in a wire socket, fast in the top projection of the square piece of metal, *b*, on the traverse-bar. From the spindle-rod, G, it passes upwards, and over the horizontal glass guide-bar, *o*, whence it descends and passes beneath the glass end, *p*, of the longer arm of the oscillating lever, Z, and finally over the porcelain guide-arm, *n*, to the winding spindle. So long as the thread passes on unbroken, its tension thus bears up the end, *p*, of the lever, Z; and this lever being continually traversed up and down along with the bar, M, each time it arrives at the top of its stroke or rise, its short end comes in contact with the under side of the front end, *g*, of the curved lever, *f*. This action depresses the opposite end of the lever, the detent of which thus partially turns the ratchet-wheel, *i*, and through it the inclined shaft, V, in the direction of the arrow, so as slightly to lower the pin, T, resting on the scroll, U, and with it the winding spindle, with the pirn or cop in the act of being formed. Each upward traverse of the bar, M, produces, in this way, a slight descent of the winding spindle, so as to cause a uniform build of cop.

Our illustrative figures show the machine as at work with the thread winding on in an unbroken stream, the lever being held up by the thread, and giving the requisite movement to the shaft at each upward rise. The dotted portions in fig. 2, however, show the state of matters when the thread has broken, the lever having fallen down on the absence of the tension of the thread. The short end of the lever in this position rises and falls without coming in contact with the curved lever, *f*, and the spindle being thus arrested in its gradual vertical descent, the building action of the cop ceases, until the thread, being pieced, causes it to go on as before. The effect of this movement is, that however frequently the thread may give way, the accuracy of the build is never interfered with, as, when the thread has been pieced, the building goes



Printed by Mackay & Kirkwood, Glasgow



Scale 1/4 th.

Engd by G. Aikman, Edinr

on from the exact point of the cop at which it previously ceased, although the other movements of the machine have been constantly going on. At the same time, the thread of the cop suffers no injury by the frictional pressure of the building cone, or other apparatus ordinarily used for the regulation of the laying-on. Each spindle has a separate traverse apparatus, so that the breaking of a thread acts only upon that particular spindle. In the ordinary action of the machine, the revolution of the scroll, U, and the consequent gradual descent of the spindle, continues until the cop being completed, the spindle is lowered far enough to bring its driving-band upon the loose section, *q*, of the warve, I. The movement of the spindle is thus suspended, and the suspension of the dragging tension of the thread permits the end, *p*, of the lever, Z, to fall, so that it no longer turns the shaft, V, and the vertical descent of the spindle thus ceases also. When a new cop is to be formed, the attendant brings up the spindle to the starting point, by turning the handle, *m*, fast on the shaft, V. The frictional connection of the worm-wheel, *k*, allows of this being done without interfering with the rest of the mechanism. The stop-pin, *r*, in the scroll, adjusts the spindle to the right height, by coming in contact with the side of the stud, T.

Observant visitors to the textile department of the Exhibition of last year, may remember the excellent working of the small machine under the superintendence of Mr. M. Gray, the practical worker-out of the contrivance. Mr. Gray has also constructed two other modifications of the same principle. In one of these, the stop movement for the building action, which is the only different arrangement, is worked from a single continuous horizontal shaft, running along the whole length of the frame, and revolving at a slow rate in bearings at the level of the tops of the spindles. The supporting lever of the spindle is suspended by a chain passing up, and attached at its higher end, to a pin in the periphery of a narrow pulley, loose on the long shaft just referred to, but in connection with it by stiff friction. During the winding action with an unbroken thread, the slow revolution of the shaft gradually unwinds the chain from its pulley, lowering the spindle to effect the desired building movement. But when the thread breaks, the oscillating lever action throws the pulley out of gear with the shaft, to stop the descent of the spindle until the thread is pieced.

For some purposes, this friction movement, as well as the arrangement illustrated in our plate, may be used with advantage without the oscillating lever movement. As, for example, where coarse, strong yarn is wound, fracture will occur at very distant intervals, and when detected by the eye of the attendant, and set right, the proper building position of the spindle may be easily adjusted by hand. After forming a full cop, the spindle is trimmed up to its starting-point by turning the band-pulley by its handle, so as to wind up the band, and elevate the spindle correspondingly. This last arrangement is coming rapidly into use for heavy yarns. It is simple and easily managed, whilst it answers all practical requirements in the special application to which we have alluded.

DERING'S ELECTRIC TELEGRAPH.

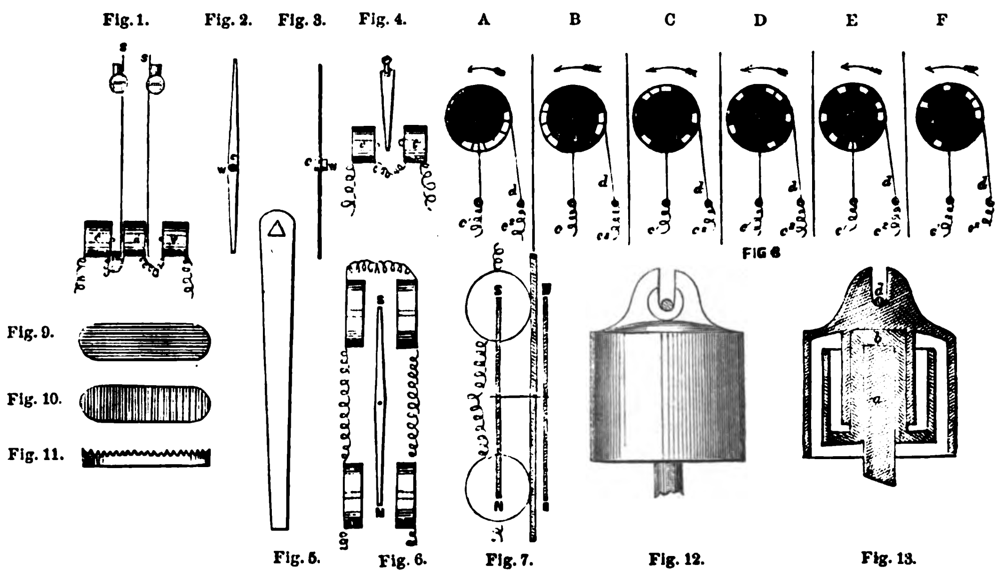
In our July part, we briefly referred to a peculiarly ingenious telegraphic arrangement, just adopted, for facilitating the internal communication of the Bank of England. That telegraph is the invention of Mr. G. E. Dering, of Lockleys, Welwyn, Herts—a gentleman who has ardently devoted a considerable portion of his life to this branch of improvement, and with an amount of success sufficient to warrant us in devoting some further space for an explicit statement of the details of the inventor's plans. In working them out, Mr. Dering has lessened the first cost of the instruments, as well as their working expenses, whilst he has increased the speed of communication, and has secured the power of transmitting secret intelligence without involving the use of additional line wires. The chief features of the plans may be thus stated:—

1. A new system of motion for the indicators by which the intelligence is read—very sensitive and instantaneous in action, and free from oscillation. 2. Arrangements for insuring greater quickness and certainty of action in the common indicators, whilst the battery power is reduced. 3. Dispensing with the additional wires used for ringing the alarums. 4. The conveyance of secret intelligence, by using an apparatus which cuts off the communication with all the stations except one or more, as may be selected by the operator, the excluded stations being easily brought into the circuit when required. 5. The protection of the apparatus from the effects of lightning, or currents of atmospheric electricity collected in the suspended wires. 6. A better mode of insulation for the line wires.

In carrying out the first of these heads, the inventor employs elastic magnets, or rigid magnets having flexible elastic supports, dispensing with axes of suspension; the elasticity being sufficient in either case to allow of the proper amount of motion. Permanent magnets, or soft iron or other magnetic metals rendered magnetic, and therefore for the time being magnets, may be employed for this purpose. The elastic magnets form an extremely delicate system of motion for indicators, and may be applied with great advantage where sensitiveness is an important object.

In fig. 1 of our engravings, the letters s, s, represent a pair of elastic steel magnets attached by their upper ends to two brass studs, the lower ends being free to move, each in one direction, when acted on by an electric current passing through the coils of wire, *c*, *d*, *e*. If soft iron or other magnetic metal be employed, the ordinary well-known means of keeping them in a magnetic state will be resorted to. In the figure referred to, the indicators are represented as elastic and flexible from end to end, but they may be constructed partly rigid and partly elastic and flexible, or that they may be rigid magnets from end to end, supported by any flexible elastic substance.

The second improvement relates to the means of restoring magnetic needles, or other moveable telegraphic arrangements, to their ordinary position of rest, after they have been caused to deviate from such position by the passage of an electric current.



The plan consists in placing the centre of gravity immediately below the centre of motion, instead of at a point considerably below it, as has hitherto been the case. To effect this: First, in the case of the ordinary astatic needles and similar arrangements,—the portion of the instrument which is below the centre of motion does not preponderate over the upper portion, as is usually the case, but its upper and lower portions are so balanced, that it will remain in any position in which it may be placed; and to give it a proper tendency to assume a determined position, a separate weight is attached immediately below the centre of motion. A quick return to the position of equilibrium is thus insured, on the principle of the quick beat of a short pendulum as compared with a long one.

Figs. 2 and 3 show respectively a front and side view of a magnetic needle, brought to the vertical position solely by means of the weight, *w*, placed immediately below the centre of motion, *c*. Another mode of applying the same principle consists in suspending the magnetic needle,

or other moving instrument, by its upper end. The whole, or nearly the whole, of the weight being thus immediately below the centre of motion, it becomes unnecessary to increase the weight at a lower point. The needles may be fixed in the usual manner upon an axis passed through the upper end, as near as possible to the very extremity; but it is preferred that one or both of the pivots on which the axis turns in this and all similar arrangements, should rest in an angular aperture, and not in round holes, as is usually the case. This has the effect of diminishing the oscillations which the needle makes in returning to its position of rest.

Another mode of suspension consists in forming, at the upper extremity of the needle, an aperture having an angle for its upper edge, and suspending the needle by this aperture from a hook of round wire. There are thus two points of contact between the needle and its support, both parallel to the plane in which the needle moves, the effect of which is to prevent all uncertain movement, and reduce the oscillation to a minimum.

Fig. 4 represents a magnetic needle suspended by its upper extremity, and acted on by the coils of wire, c, c^1. Fig. 5 is an enlarged view of the needle, showing the mode of suspension by an angular aperture from a hook of round wire. Another plan is to suspend the needle entirely by attraction from a fixed piece of soft iron, or from a permanent magnet, in which case the needle may be of soft iron, or other temporarily magnetic metal, and derive its magnetism by induction from the bar which supports it. In all these arrangements the needle should be of the usual flat form, its movements taking place in the direction of its breadth. This may be effected in cases where it is suspended by attraction, by rounding the upper end, and forming an angular groove for it to work in, in the extremity of the supporting bar.

In applying electric currents to produce motion in needles and other magnetic bodies, the direct attractive or repulsive action exerted upon magnetic bodies, is applied by coils of wire of circular or other convenient form on the passage of an electric current through them, in place of the deflective influence which has usually been employed. In all cases the coils are placed in such a position, that their axes shall be in or parallel to the plane of motion of the magnetic body they are intended to influence. Such an arrangement of coils may be applied with great advantage to the ordinary astatic needles, or to the simply suspended needles last described.

Figs. 6 and 7 represent this arrangement of coils in connection with the ordinary astatic needles, and in figs. 1 and 4 are also shown applications of the same principle. In some cases, soft iron is placed within the coils of wire, but the length of such soft iron pieces should not exceed their diameter, since by this plan residual magnetism is altogether prevented.

The fourth improvement relates to the sounding of telegraphic alarums, and its object is to prevent all unnecessary ringing of the bell during the transmission of messages, and at the same time to dispense with the extra wire usually employed for that purpose. The arrangement is especially applicable to the double-needle instruments now in general use, or to any kind of conventional signal telegraph in which two or more circuits are employed. To effect the desired object, the use for signalling purposes of any one particular signal decided on, that is produced by a single current passing in either direction through any one wire, or of contemporaneous currents passing in any direction through any two or greater number of the wires, is dispensed with, and the bell apparatus at the stations is so arranged, that they shall be acted on only when such current or currents pass as would produce the omitted signal.

To take the case of the double-needle instruments now in use. Let some one of the eight simple signals that such instruments are capable of giving (the mutual convergence, for instance, of the lower ends of both needles), be set aside altogether from the code of signals, and let the electro-magnets which act upon the alarum, and which are in the circuit with the needle coils, be so arranged that they shall release the clockwork of the alarum only when such currents pass as would produce the omitted signal.

These electro-magnets are to act on moveable permanent magnets, and not on soft iron armatures; thus each electro-magnet will act only when a current is passed in one direction, and the moveable magnet will not be moved from its position of rest by the reverse current, and the concurrent movement of the two permanent magnets is to be required to release the clockwork alarum. Then it is obvious that the alarums can at any moment be rung by transmitting this signal; but that they can never ring during the transmission of a message, as this particular movement of the needles is never employed to indicate a letter or sign, or for any purpose except that in question.

The fifth improvement consists of an apparatus, by the use of which, without extra wires, intelligence may be transmitted from any station on a line to any other station, at choice, or to any number of them at the same time, without a possibility of its being seen at the rest, as is now the case.

The means of effecting this object are as follow:—At each station there is mounted a metallic disc, revolving on an axis, and capable of being impelled round step-by-step, like the seconds' hand of a clock, by any of the well-known electro-magnetic arrangements for such purposes. There is a metallic spring constantly pressing upon the circumference of the disc, and into certain points of the circumference of each disc there are inlet portions of ivory, or some other non-conductor of electricity. The metallic bearings of the disc, and the spring which presses on its circumference, are placed in connection, each with one extremity of the coil that actuates the needle, or other arrangement employed to indicate the signals, the coil being included in the circuit of the line wire as usual. The discs move uniformly step-by-step at all the stations, and they may be set in motion, and brought to any desired position, by passing a current of electricity from any station the proper number of times.

Now it is clear, that so long as the spring at any station rests upon the conducting portion of the circumference of the disc, there is a short circuit established, by which the electricity may pass between the extremities of the line-wire, without passing through the coil which actuates the indicator; consequently, signals transmitted from any other station will not be shown at this instrument. But if the disc be brought to a position in which the spring rests upon a non-conducting portion of the circumference, the short circuit will in this case be broken, and every signal must in its course along the line-wire pass through the indicator coil, and thus show itself in the usual manner. It will also be readily understood, that by arranging, in a certain known order, the inlet non-conducting portions of the circumference of the discs, a means is obtained of bringing any one or more stations that may be desired into the line of communication, it being only necessary first to pass the current such a number of times as to bring the non-conducting portions of the discs at these stations under the spring, and the conducting portion at the others. Upon the axis of each disc there is a hand, which traverses a circular dial-plate, on which are inscribed the different combinations of two or more of the stations that are brought into the line of communication at each step of the revolution of the discs. It is convenient that there should be one point at which every station is brought into the communication, and at this position of the discs the hand upon the dial may be made to point to the word ALL, inscribed thereon.

As the electro-magnetic arrangement which actuates the disc is included in the same circuit with the coil that works the indicator, (in order to avoid the extra line-wire,) it is necessary there should be some means to prevent the disc being acted on during the transmission of currents that are intended only to work the indicator. In the case when currents in one direction only are employed for signalling purposes, those in the reverse direction may be devoted to the purpose of impelling the disc: the methods of accomplishing this are well understood. Where both directions of the current, however, are required to work the indicator, as in the case of the ordinary needle instrument, other means must be resorted to.

First, if the electro-magnet which actuates the disc be so arranged as to act only upon the application of a current stronger than that required to work the indicator, all chance of it acting when ordinary signals are transmitted will be removed, whilst the disc may be actuated with certainty by the application of an increased battery power.

Secondly, there are various arrangements by which the disc electro-magnet may be prevented from acting when the ordinary signals are transmitted, whilst, at the same time, it may at once be brought into action by the transmission of some extraordinary signal not included in the code, such as, for instance, the continuous passage for several seconds of a current in one direction. To effect this, there is a wheel kept constantly in motion, slowly upon its axis, by clockwork; and near to this wheel there is an arm, which is moved by an arrangement of an electro-magnet acting on a permanent magnet—only when the current passes in one direction—and brought in contact with the revolving wheel, in which there are apertures to receive it. When in contact with the wheel it partakes of its motion, and if held so for a sufficient length of time, it is brought to a position, from which it will not return to its usual position upon the cessation of the current, but it may be at once released by a current in the reverse direction. When in the position to which it is brought by the revolution of the wheel, a portion of the arm which forms a driving pallet is brought to a position in which it will act upon the ivory and brass disc above described, by which stations are brought into or thrown out of the circuit, and by repeating the current a certain number of times the disc may be brought to any desired position.

Thus it is obvious that the station-disc can never be moved during the ordinary transmission of signals, but it may be brought into a posi-

tion to be acted on, at any moment when required, by passing a continuous current as described. Then the disc electro-magnet may be actuated the desired number of times by currents passed in the same direction as those by which it was brought into action, and thrown out of action again by a single current in the reverse direction. The mechanism for effecting this object may be greatly varied; the same principles are applicable to various similar purposes, such as to govern the movement of printing telegraphs, or to sound the alarums of single circuit needle and other kinds of telegraphs; thus allowing the extra wires usually employed to be dispensed with.

Fig. 8 shows the application of the secret apparatus to six stations working in circuit. A, B, C, D, E, F, are the brass discs of the different instruments with such an arrangement of the inlet ivory portions of the circumference as will admit of any two of the stations being brought together into the circuit, and the others excluded, or of all being brought in at the same time, according to the position the discs are brought to, moving as they do in unison by step-by-step motion, as described; c^1 and c^2 show the terminals of the indicator coil, or similar arrangement, at each station; and *d*, in each, shows the platina spring in contact with the edge of the revolving disc.

The sixth improvement relates to a means of counteracting the currents of atmospheric electricity, which are at times collected in suspended telegraphic wires, and manifest themselves by continued deflections of the needles, or similar arrangements. To effect this, there is introduced into the circuit of the line-wire a galvanic battery, or other suitable generator of electricity, the current from which being passed in the contrary direction to that which it is intended to counteract, may be regulated in force to a degree exactly sufficient to restore the needle to its ordinary position of equilibrium.

The seventh improvement is for the purpose of preventing the more violent effects of atmospheric electricity, such as the fusion of the coils and demagnetization of the needles. The plan consists in interposing between two flat surfaces of brass, or some other conductor of electricity, roughened by a file or any suitable means, a thin piece of linen or other porous imperfectly-conducting material, which will allow of the roughened surfaces approaching one another to within an extremely short distance, without actually coming in contact. These surfaces are placed in connection, one with the line-wire and the other with the earth, or one with each end of the line-wire, between the line and the internal works of the instrument. By this means the greater portion of a shock of atmospheric electricity is prevented entering the instrument, as it will pass direct from one of the roughened surfaces to the other, and through the intervening space, this being the most direct path, instead of making a circuit of the coils of the instrument. The protective power of this arrangement is increased, if grooves be formed in one or both of the opposed conducting surfaces, in such a manner that the face shall present a series of sharp ridges. Where both of the surfaces are grooved, they are to be placed together in such a position that the ridges may cross one another, and a ready path for the electricity will thus be provided, as each crossing is equivalent in its dispersive power to a pair of opposed points.

Figs. 9 and 10 show the surfaces of the two opposed plates; and

Fig 11, an edge view of fig. 10.

One advantage of these arrangements over the system of balls and points that has been in use for the same purpose, consists in this, that there is no accurate adjustment of the parts required, and moreover, there is no danger of chance contact between the opposed surfaces, which may occur in the other, to the total derangement of the line of communication.

The eighth head relates to the same purpose as the last, and consists in applying the repulsion which takes place between similarly electrified bodies, or the attraction between those dissimilarly charged, to make or break connections, in such a manner as to carry off, and thus protect telegraphic instruments from the destructive effects of electricity collected in the suspended wires. From a fixed brass piece, let there be suspended by wires two brass balls, which rest in their ordinary position lightly in contact, but are capable of separating one from the other by mutual repulsion, on the application of a small amount of electricity of tension. Near to the balls are mounted two brass plates, in such a position that the balls on separating come in contact with them. The balls are, for security, mounted in a glass tube. The brass piece which supports them is placed in connection with the line-wire, between the line and the internal works of the instrument. The pieces in juxtaposition with the balls are united with the earth, and it is obvious that any atmospheric electricity must, by this arrangement, be prevented from passing to the works of the instrument, since a short course to the earth is opened for it by the mutual propulsion produced by itself in the balls, causing them to come in contact with the conducting plates arranged for that purpose.

The foregoing is, perhaps, the simplest application of this principle of protection. The various modifications of it will readily suggest themselves, and amongst others, the plan by which the separation of the suspended balls, or other effect of the collected electricity, is made to break connection for the time between the line-wire and the instrument, and thus effectually prevent damage.

The ninth improvement is also for the purpose of protection against atmospheric electricity. It consists in introducing into the circuit of the line-wires, between the line and the internal works of the instrument, a strip of gold or other metallic leaf. By this means the coils and other parts are effectually protected from damage, as a shock of lightning could not reach them without passing through the metallic leaf, and it cannot proceed farther than this point, as it will fuse the leaf, and thus cut off communication with the instrument. For security, this strip of leaf is mounted in a glass tube, capped with brass at the two extremities, which form the terminals of the line-wire and instrument.

The last improvement relates to the insulation of suspended telegraphic wires. It is an improvement upon the ordinary bell-shaped insulator, and consists in fixing within it an inverted smaller bell of insulating material, the edges of which must not be in contact with the outer one. It is by the inner bell that the insulator is attached to the post or other support, by means of an iron arm. The wire passes through a proper aperture in the upper part of the outer bell. Cast-iron, protected from rust by a coating of zinc, or other means, is preferred, as the material for this portion of the arrangement; its edge should come below, and thus entirely surround the inner insulating part, which is by this means effectually protected from damage by stones thrown, or other violence.

Fig. 12 is an external view of this insulator; and

Fig. 13 shows a section of the same. *a*, is an iron arm attached to the post or other support; upon it rests the earthenware piece, *b*, and over this fits the metallic cap, *c*; *d*, shows a section of the line-wire, supported in a groove or other aperture for the purpose. The same principle of insulation may be applied with advantage to the apparatus for stretching telegraph wires; also to break the continuity of the line-wire, where it is intended to insert an instrument in the circuit, and for other similar purposes.

SCIENCE.

III.

Let us now take a cursory view of some of the benefits which have resulted from scientific inquiry. The merely practical man of the world is wont to smile at, if indeed he do not disdain to regard, the labours of the man of science. This, no doubt, arises in a great measure from his entire unconsciousness of the very means it has afforded him in prosecuting even his selfish ends. Such a one is apt to exclaim at the observations which he cannot fail to hear are made by astronomers, chemists, and geologists, "Of what use are they? How am I benefited by knowing the laws which regulate the apparent position of the stars, the composition or decomposition of bodies, or their superposition in the bowels of the earth?" "What's the use o' *picturs*," said a certain mayor, "can't eat un, can't drink un; what's the use o' picturs?" The other worthy is of the same kindred with the illustrious town-chief. In truth, it appears to be impossible to show an immediate practical use of the new facts which science is constantly evolving. Day by day, however, are some of these beautiful revelations made, reminding us that certain knowledge which we acquired in early life, and knew not then the advantage of, when we have reached manhood, is found to have been an indispensable mean to our individual progress. How nobly does the scientific mind rest on these things! Although, in many cases of discovery, the benefit may be remote or even unimaginable, there exists in every such mind an ineradicable conviction, rather than a mere hope, or even faith, that every new fact is productive of good. Literature (so far as it is not a record of simple facts, or does not furnish in itself a museum of such facts) is too often converted into an instrument of mere ephemeral pleasure, both in author and reader. The arts rise and set, but science is built on a more lasting foundation—the foundation of incontrovertible and ineradicable truth. Enjoyment of the pleasures of literature, in the pages of the novelist, or even the historian (as history has yet, except in one or two instances, been written), depends greatly upon the associations of time and place; that of science is capable of being procured in all time, in all place, heedless of any other association but with the True, and therefore the Good and the Beautiful, those sister harmonies which ever accompany the prosecution. And why is this? Man and his ephemeral position form the dying memorials of letters, while the imperishable record of science is the result of the analysis of the macrocosm of nature. Broken relics of the divine statuary of Phidias and Praxiteles are barely preserved to us,

while all the paintings of Appelles have perished; but the wisdom of Archimedes, and other ancient mechanicians and geometers, who applied their attention to physical facts and abstract truths, have been inscribed, as it were, with an iron pen on the rock of time for ever.

In relation to the chief object or aim of science, one of its principal benefits is in compelling us to reject, as false, all crudities of the pure imagination, every impression of mere fancy. The anchor of its hopes can find in them no ground of sufficient tenacity to secure the ship of thought, when it occasionally nears a lee shore in its progress to its destined haven. All these are rejected as nursery tales, together with every statement incapable of being proved, resting upon mere authority. The notable "wisdom of our ancestors" rested in a state of perfect self-complacency when it established, and for ages accredited, the stories which told how the pelican drew blood from her breast to feed her young, —how the chameleon lives on air,—how the porcupine has power to shoot forth its quills against a pursuing enemy,—how a multitude of other strange things were made to do what, somehow or another, they can by no means be made to do now. The truth is, that it needs but a very slight introduction into science to reject all such properly called "old wives' tales." It teaches us, moreover, to feel justified in smiling at the vagaries of judicial astrology, and at such conceits as that writer on anatomy displayed, who asserted that a certain bone near the inner orbit of the eye, was purposely made by nature thin, in order that it might be more easily perforated by surgeons in disease!*

Again, the observer of facts becomes an original thinker. It is such alone who originated and have kept alive, in all civilised tongues, the word "progress." Look through history, trace the channels of biography, and it would seem to be a law, that an original thinker should seldom or never exist without exposing new beacons to guide, or without improving some one, at least, of the many ways of human attainment. Let *facts* be the object of thought, and *truth* the rule of thought, then all false opinions, all senseless theories, must be exterminated. We shall thus preserve both ourselves and others from deception, and from the waste which takes place of that precious time, when results are sought after that can never be obtained.

This leads us to remark, that the correct measure of time, so important in every pursuit, is ascertained by observation of the daily revolution of the earth upon its axis, the monthly revolution of the moon round the earth, and the yearly revolution of the earth and moon round the sun. Hence (unless some great change takes place in our solar system, or the loss of arithmetic figures occur) years, and months, and days will remain the same known lengths for many ages. The year will be divided into three hundred and sixty-five days and a fraction,† except in those called leap years, (and in another case which we need not now mention,) when it is necessary to have an intercalary day, in order to adjust our measure of time to the actual appearance of the bodies existing in space; the day will be divided into twenty-four hours; the hour into sixty minutes; and the minute into sixty seconds.

This conclusion conducts us to another observation. The "second" having been obtained, a pendulum can be constructed which (acting by gravitation) shall, when put in motion in the latitude of Greenwich, perform one oscillation in exactly one second of time. If we were inventing measures, the length of this pendulum might be called a yard. This yard might then be decreed by the legislature to be the standard of length, which would, at all events for an immense period, be sensibly unaffected by time, being thus obtained by strict science from a natural standard which, for the purpose, we presume, is unalterable. Thus would this standard, unlike the arbitrary rod prescribed to be the standard by Act of Parliament, be not only unaffected by heat or cold, but incapable of being destroyed or even damaged by fire. It is a fact that, upon the occurrence of the calamity which struck the Houses of Parliament, the standard yard measure was actually destroyed. The object, however, of having a standard measure of length, which may remain unaffected by either of these means, is obtained with sufficient accuracy for ordinary life, by measuring such a pendulum as we speak of in yards, by the yard-measure in use at the time. Fortunately, commissioners had, previous to the catastrophe mentioned, been appointed for the express purpose, and the measurement was found to be one yard, three inches, and a fraction of an inch. Thirty-nine inches, with a decimal of 1293, is nearly correct. Thus our standard measure of length, so indispensable in daily commerce, has been, and may at any time hereafter be determined, whether the standard rod be destroyed or not; for we can always have recourse to the pendulum.

Our standard weight has also been determined by science. It was found that a vessel, whose interior is a cubic inch, when filled with distilled water, has its weight increased by about 252 grains—252·458 is nearly correct. Of these grains, it was ascertained that 7000 made up a pound avoirdupois, and 5760 a pound troy, so that, in this case also, if even all the copies of our standard weights were lost or destroyed, they might, by reference to this, their natural standard, be restored.

Another remarkable instance of the benefits conferred by science is in the case of Artesian wells (called so from some supposition of their having first been constructed in Artois in France). To those who are ignorant of the elements of geology, and for whom, not alone, the papers which are appearing on that subject in another portion of our *Journal* are intended, it may be mentioned that the crust of the earth, upon which we tread, has been found not of the same character with regard to soil throughout any depth to which we may penetrate, but that successive layers of strata, very often of very different character, such as clay, chalk, freestone, sand, appear, all of which respectively, in some localities, "crop out," as it is termed, at the surface. Certain of the rocks, &c., overlie certain others of them, and are found to dip down from the surface. Some of these soils are permeable to water, as shingle and sand; and others, like clay, are classed among the impermeable strata. In some cases, these strata, differing in permeability, lie in a basin-form; and we shall see how remarkable it is, that some of the principal cities of the world, including London and Paris, are built upon such basins. To such populous places especially, is good water an absolute necessity. The difficulty of procuring it in quantities sufficient for general sanitary purposes, is often extremely great; but by the knowledge of this difference between the strata composing the crust of the earth, and which has thus been ascertained by the science of geology, and also by the knowledge of one of the simplest laws of the science of hydrostatics, viz., that water, when left free, will always rise to its level, the engineer has been enabled to lay down his apparatus, and obtain the purest water in immense quantity, all naturally filtered through all the permeable strata lying between the surface of the impermeable stratum to which he pierces, and the surface of the top soil, upon which, by rains or otherwise, the water is originally received. Several of such wells have been made in or near London. The fountains in Trafalgar Square are supplied by one, which also furnishes more than is required for the baths and wash-houses of St. Martin-in-the-fields. The most celebrated is that in the plain of Grenelle, near Paris, which in a few days produces water sufficient for the whole of the French capital for a twelvemonth.

Such are some of the gifts which science has made to the world. Our space will not allow us at present to refer to any more. But what benefits may not still be anticipated, when, if we ask an individual in Britain, "What science has done?" he must tell us that, by anatomy and physiology, it has lessened, in some cases annihilated, pain, and lengthened life. By assisting navigation, it has brought his food from the coast of Newfoundland, and from within the wall of China, and has made it more grateful to his palate with the sweet cane of Jamaica and the spices of Hindostan. It has regaled his sense of smell with the perfumes of Arabia, and his eye with graceful forms and brilliant colours from the torrid zone. It has clothed him with the cotton of America and the silk of India, and may have decorated his bride with the pearls of the East, and the gold of the great island-continent of the far south. By optics, in the improvement of lighthouses, it has prevented shipwreck to the mariner, and, by application to eye-glasses, has aided imperfect vision. By acoustics, it has assisted defective hearing. By mechanics —that interesting and useful science, upon which our own labours are founded—it has exposed an infinite number of other fields of energy to man's intelligent and muscular frame. By architecture, it has protected him with elegance against the ravages of the storm, and has made his hearth at home comfortable. From the dark bowels of the earth it has enabled him to extract a substance which has made midnight (using a simile adopted by the most popular historian of the day) as brilliant as the noon. It has brought him to produce ice in an atmosphere of intense heat, and the flowers of the tropics in our temperate clime. By accelerating locomotion, it is contracting distance. It has enabled him safely to descend the ocean-depths—to float above the highest clouds. His hours of labour or amusement can, by means of the telescope or the microscope, be employed in observing and acquiring the information of new facts regarding worlds of being, infinitely large or infinitely minute, utterly unimagined but a very few years ago. In short, it has extended his assigned dominion "over all the earth." If we ask nations, they must tell us that scientific agriculture has increased the fertility of the soil. Political economy and jurisprudence, founded on statistical facts, have enlightened their polities, and are perfecting their laws; and they are themselves, in their people, raising new sanctions towards the protection of liberty, life, and property. It has changed aggressive war into defensive war, and, making this a rarer thing, it has given, by the induction of habit, a new security for peace. By the already no longer wonderful electric telegraph, science is instantaneously and momentarily

* The bone—the *os unguis;* the disease—*fistula lachrymalis.*

† Of nearly ¼: 365·24225 is nearly correct.—*De Morgan.*

proclaiming her triumphs from corner to corner of the kingdoms; while, by extending the knowledge of the natural foundations of human laws, it has added wisdom to counsel, given increased strength to properly established empire, and confirmed the bond of union between man and man. If we ask the whole earth, it must tell us that it has directed the lightning to pass harmlessly in its transit; it has exterminated or mitigated the subtle poison of the pestilence; and is progressing, gradually, but surely, in teaching the real distinctions between apparent truth and apparent falsehood, apparent right and apparent wrong; and by these means dispensing the innumerable blessings of civilization over a barbarian world.

DOULL'S IMPROVEMENTS IN RAILWAY CONSTRUCTION.

(*Illustrated by Plate* 106.)

Mr. Alexander Doull of Greenwich, the engineer of the South-Eastern Railway, has just patented and introduced some important novelties in the construction of the permanent way of railways, which may probably be interesting to some of the readers of the *Practical Mechanic's Journal.* What the several plans propose to effect may be made out from our plate.

Fig. 1, on plate 106, is a perspective elevation of a portion of a rail with a chair and wedge, showing one of Mr. Doull's ingenious modes of securing the wedge in position by a longitudinal bolt; and fig. 2 is a plan of the same corresponding. The chair is a slight modification of the common cast-iron kind, the rail being held within it by the lateral pressure of the timber wedge, A, which is drawn up and held to its bearing surfaces by the bolt, B, the respective contiguous surfaces of the wedge and chair being slightly grooved out in a horizontal direction, to admit the bolt to come in between them, and lie parallel to the web of the rail. To give an extended bearing surface to the cheeks of the chair, they are cast with prolongations, C, on each side—one cheek being formed to the same incline or angle as that of the wedge. Thus, to receive the bolt, the thick or back end of the wedge is recessed out in a line parallel with the rail, whilst the opposite end of the chair cheek is similarly formed to continue the line of the bed of the bolt. In laying rails on this plan, the wedge, A, is first set in its place—or the wedge and bolt may be laid in together—and the wedge is then screwed home by the pressure of the bolt head, D, on the butt of the wedge, arising from the screwing up of the nut, E, upon the end of the bolt passing through the projecting cheek of the chair. In this way the wedge is easily adjusted in position, without being subjected to the damage ordinarily produced by driving with a maul. It is also clear that, as the hold is not due to the mere frictional wedge pressure, the wedge is securely held up when once fixed, obviating the necessity for the constant attendance of the plate-layer to examine and tighten up slack wedges.

This system of adjustment is obviously applicable only to chairs cast expressly to suit; but Mr. Doull also provides for its adaptation to the various forms of the ordinary chairs. This is effected by the use of the small wedge-casting, F, shown on an enlarged scale in fig. 3, and also as adjusted in its position, in a chair of Ransome and May's pattern, in the plan, fig. 4. This casting is formed with a central notch, or shallow recess, G, on one side, to fit to the cheek of the chair; and it has besides a longitudinal bolt-hole passing through it nearly from end to end, commencing with a long slope at H, on the inner wedge surface, and coming out at I, in the butt. This piece being laid in the chair, between the cheek and the rail, the timber wedge, J, slightly recessed at its thick end to receive the bolt, is then inserted, and the bolt is passed between the wedge surfaces and through the hole, H, I, in the piece, F. As the nut, K, is screwed up, the end of the piece, F, answers as the bearing surface for the nut, whilst the bolt-head, L, presses home the wedge—the notch, G, preventing the metal wedge from getting disengaged. Fig. 5 is a side elevation of a line of rail carried on transverse timber sleepers, and held down by a wrought-iron chair made in two separate pieces. Fig. 6 is a corresponding transverse section of the rail, intermediate chair, and sleeper. Fig. 7 is a transverse section of a rail and chair, illustrative of another modification. These chairs are rolled in lengths of 15 or 20 feet, and then cut transversely to suit the respective lengths of the intermediate and joint chairs—the former being about 4 or 5, and the latter 18 inches, or 2 feet long. To allow of rolling the chairs with facility, they are made in two parts, the division line being in the centre at M, beneath the rail, but it is possible to roll them in one piece. The intermediate chairs, as delineated in our example, are fastened to the sleepers by a bolt or rivet, N, to each half, and to the rail by a single transverse bolt or rivet, O. The joint chairs are precisely similar, except that they are five or six times as long. They are held down on the sleepers by four bolts or rivets, two on each side; and to the rails by four transverse bolts, two on each side the rail joint—the holes in either the chairs or rails being slightly elongated horizontally to give expansive play. Thus, in addition to giving an extended bearing surface to the rail ends at their junction, these wrought-iron joint chairs afford a uniform strength and stiffness throughout the entire line, and remove the deeply experienced fault of loose joints; and it is probable that the stability thus secured will render it unnecessary to bolt the intermediate chairs to the rails at all.

Where timber sleepers are used, the arrangement shown in figs. 8 and 9 may be adopted. Fig. 8 is a side elevation of a line of rail, and fig. 9 is a corresponding plan of the line. Here two longitudinal sleepers, A, and two transverse ones, B, are used for every 15 feet of road. The longitudinal sleepers for the joints are about 9 feet in length; and, in addition to the long-joint chair, there is an intermediate chair, C, on each side. The longitudinal sleeper is broken away at one end in our figures, so that only one of these intermediate chairs is seen; and similarly at the other end, one only of the transverse sleepers is shown. The distance between each pair of transverse sleepers is 10 feet, giving a cross tie sufficient to preserve the guage of the line. In sharp curves, where a more powerful transverse tie may be required, four such sleepers may be put into every 15 feet of roadway; or, instead of this, two ties of wood or iron may be introduced between the longitudinal sleepers, as indicated by the dotted lines in fig. 9. If four cross sleepers are employed, the longitudinal sleepers under the joints may be about 6 feet long. By following either of these arrangements, and making the longitudinal sleepers 12 inches, and the cross ones 10 inches broad, and 9 feet 6 inches long, a bearing surface of from 35 to 40 superficial feet is obtainable for every 15 feet of roadway.

In the British North American colonies, or wherever timber is cheap and abundant, longitudinal sleepers may be adopted along the entire line, being notched down upon cross sleepers; and by increasing the number of intermediate chairs, so that the length of bearing does not exceed 15 or 18 inches, an extremely light rail would answer. This would suit the line to the country; for wherever timber is cheap, iron is the reverse. In bolting the chairs to timber sleepers, nuts at the bottom may be used, with their alternate corners turned up, so as to become fixed in the wood, preventing them from turning round whilst the bolts are being screwed tight; or, instead of these nuts, a substitute may be found in a short bar, made to embrace two bolts, as at Q, in fig. 7—the bolts being passed through square holes in the bar, whilst the nuts are screwed down upon the upper surface of the chair flanges.

We have hitherto discussed these improvements in connection with timber sleepers; when stone blocks are used, which details, however, we hope, will soon become extinct, some modification is called for in laying the wrought-iron chairs. Figs. 10 and 11 represent the arrangement in this case. We may suppose the stone blocks under the joints to be 2 feet 6 inches long, by 1 foot 6 inches broad, and those under the intermediate chairs, 1 foot 6 inches square, giving a bearing surface of 25 feet 6 inches for every 15 feet of roadway, with a thickness of 9 inches. The thickness of the stone may of course be varied, according to the quality and the facility of procuring a supply at any determined thickness from the quarry bed. Strong slate, 6 inches thick, would probably answer for light traffic. In attaching the wrought-iron chair to stone, the most convenient mode is to place the bolt-heads below, and the nuts above, on the chairs—the bolts being passed through a short plate of iron having square holes to prevent turning. Whether stone blocks or cast-iron sleepers are adopted, the guage of the line is preserved by the use of wrought-iron cross ties, which may be secured in position by the same bolts which hold the chair down to the sleeper. In stone, or other unyielding material for sleepers, a layer of wood, gutta percha, or other elastic material, may be placed between the chair and sleeper, to neutralise the destructive effects of vibration, and the rigid feeling so objectionable in stone blocks, as well as in many of the modern applications of cast-iron permanent way, which have proved disagreeable to the traveller, and injurious to the rolling stock.

When stone blocks are used on unexcavated ground, such as a surface line or a cutting, the blocks may be placed in a trench, cut just wide enough to suit, and of the proper guage, but somewhat deeper than the blocks, so as to receive about 6 inches of broken stone, and communicating by cross drains with side drains. By this plan the usual ballast, which, in many cases, is a very expensive item in railway construction, may be dispensed with. The same system of construction may be adopted on embankments, if well consolidated before laying.

As to the question of the difficulty of raising the blocks in the trenches for readjustment, we presume that no objection would arise in practice if the trenches were left open between the blocks, for, under such circumstances, the blocks might easily be raised and packed with broken stone. But it would be more satisfactory, as a piece of work, to allow

the blocks to take a permanent seat in the trench, any necessary adjustment being made by varying the thickness of the pieces of wood placed as packing between the chair and block.

In adapting his system of wrought-iron chairs to cast-iron sleepers, Mr. Doull forms the joint-sleeper with only one joint-chair attached to it, its great length being sufficient to give the necessary bearing surface and stability to the rail-joint. Figs. 12 and 13 show the mode of application in elevation and plan. The intermediate sleepers are considerably longer, so that a wrought-iron chair may be attached to them at each end, to give a good bearing. But in some cases it may be found more convenient to proportion the size and form of the cast-iron sleepers, so that a single chair may be attached to each, according to the nature of the traffic, and the ground on which the permanent way is laid. In fastening the chair to the sleeper, the head of the bolt is beneath the sleeper, and a square projection is cast on the sleeper, round the bolt-hole, for the head of the bolt to fall into.

Fig. 14 is a side elevation, and fig. 15 a plan of a line of rails, showing intermediate sleepers, with chairs cast in one piece with the sleepers, to do away with bolts and keys as fastenings for the rails. Fig. 16 is a transverse section of a rail laid on this plan. The chairs, A, are cast upon the sleepers, B, so that the corresponding cheeks do not come directly opposite to each other, each chair having but one cheek. They are so placed, that, when two castings are laid obliquely, in contrary directions, under the rail, the latter shall come between the cheeks, as they stand on alternate sides. Then the castings are pressed in opposite directions, until the notches at C fit into each other; and this being effected, the cheeks are brought in close contact with the rail, and the interlocking of the notches prevents the cheeks of the chairs from releasing the rail. The tie-bars, D, which are necessary for preserving the guage, are placed at the junction of the two castings, and they are bolted to each of them, as shown at E, affording additional security that the notches of the sleepers shall not be disengaged from each other by the action of the trains; and to prevent the transmission of injurious vibration, and the objectionable rigidity of hard, unyielding materials, pieces of wood, or other elastic material, are placed under the rail, and confined in rectangular recesses on the sleeper.

Mr. Doull's improvements, of which we have several examples before us, not illustrated in our plate, appear to be well calculated to add to the safety of railway travelling, in preventing the casualties of loose rails and chairs, whilst they obviously involve, at the same time, considerable economy in maintenance.

WORKSHOP ECONOMICS—KERSHAW'S PLANING MACHINE VICE.

Fig. 1.

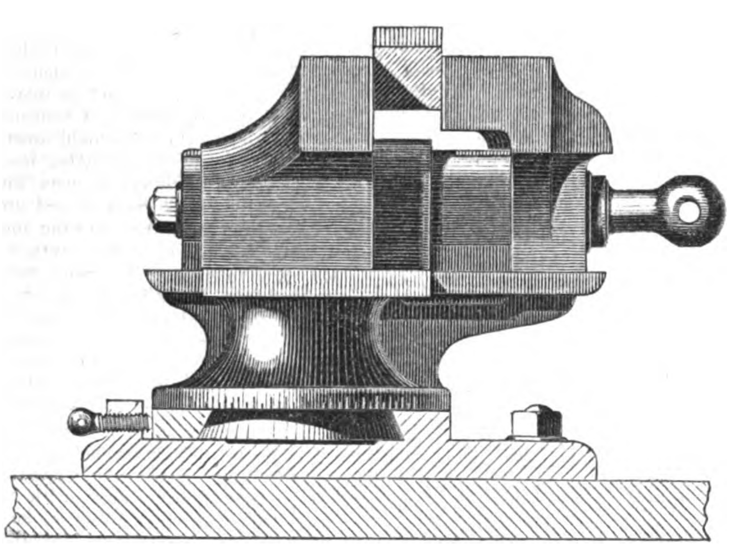
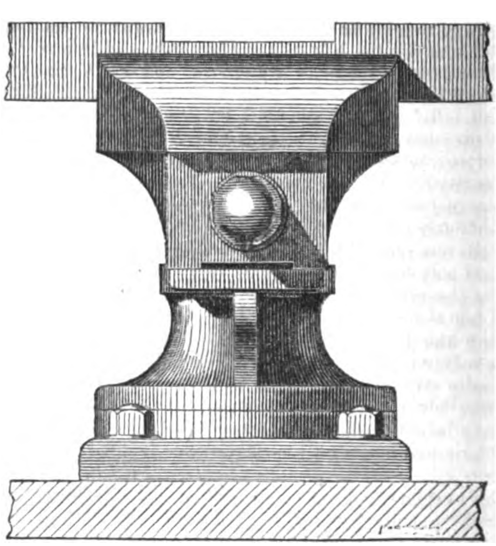


Fig. 2.



The simple addition of a vice to the planing and shaping machine, is a great convenience in working these tools. The modification shown in the annexed engravings is by Messrs. J. & J. Kershaw, the machinists of Store Street, Manchester. Fig. 1 is a side elevation of the vice, and fig. 2 is a corresponding front view—a piece of work being shown in both, as secured for planing, or cutting out. Its essential peculiarity consists in the circular dove-tail at the base, whereby the vice may be swivelled round when the set screw is slackened, so as to set to any horizontal angle, without the removal of the holding-down bolts. This is a great convenience, and aids the accurate setting, whilst it saves the workman's time.

MECHANIC'S LIBRARY.

Builder's Pocket-Book of Reference, 18mo, 5s., cloth. H. Malpas.
Electro-Metallurgy, Manual of, "Encyc. Met.," 2d edition, post 8vo, 3s. 6d., cloth. Napier.
Hydraulic Engineering, 12mo, 1s. 6d., cloth. Burnell.
Master Mariner's Hand-Book, 12mo, 6s., cloth. W. Buxton.
Naval Architecture, 2d edition, revised, 6s., cloth. Lord R. Montague.
Plane Trigonometry, First Book of, 12mo, 2s. 6d., cloth. Hemming.
Science, Guide to, 7th edition, 18mo, 3s. 6d., cloth. Rev. Dr. Brewer.
Simson's Euclid, with Corrections, 1s. 6d. R. Wallace.

RECENT PATENTS.

ENVELOPES AND PAPER BAGS.

JAMES GATHERCOLE, *Eltham, Kent.—Enrolled July* 24, 1852.

This invention is a remarkable example of the extreme tendency of modern times, to reduce the simplest matters under the dominion of complex machinery. Even the little rectangularly-folded sheet of paper which we term an *envelope*, has assumed to itself an extraordinary array of intricate mechanical contrivances, possessing curious and rapid movements, hardly to be followed by the most experienced eye, and all this is for the mere purpose of folding down the four flaps of a piece of blank paper.

As the most recent invention of the kind, Mr. Gathercole's machine may be fairly considered to embody the most valuable improvements of the day. Within the limits of a single apparatus, it executes the several processes of gumming, carrying to the creasing table, embossing, creasing, and discharging, for the complete production of the envelopes from the plain flat blanks. The blanks are placed in a deep pile upon an adjustable platform at one end of the machine, and the top one of the series is continually carried off by a pair of gumming-fingers, periodically brought over the pile, at which time the platform is elevated by a cam, so as to press the top blank against the gumming surfaces. The pile then falls, leaving the uppermost blank adhering to the fingers, and the gummer is then traversed forward to lay the blank upon the creasing table. At this instant, the seal flap being laid over its proper die, a cam overhead gives the requisite embossing action, and the carrying

IMPROVEMEN

RAILWAY CON

ALEXANDER DOULL, E

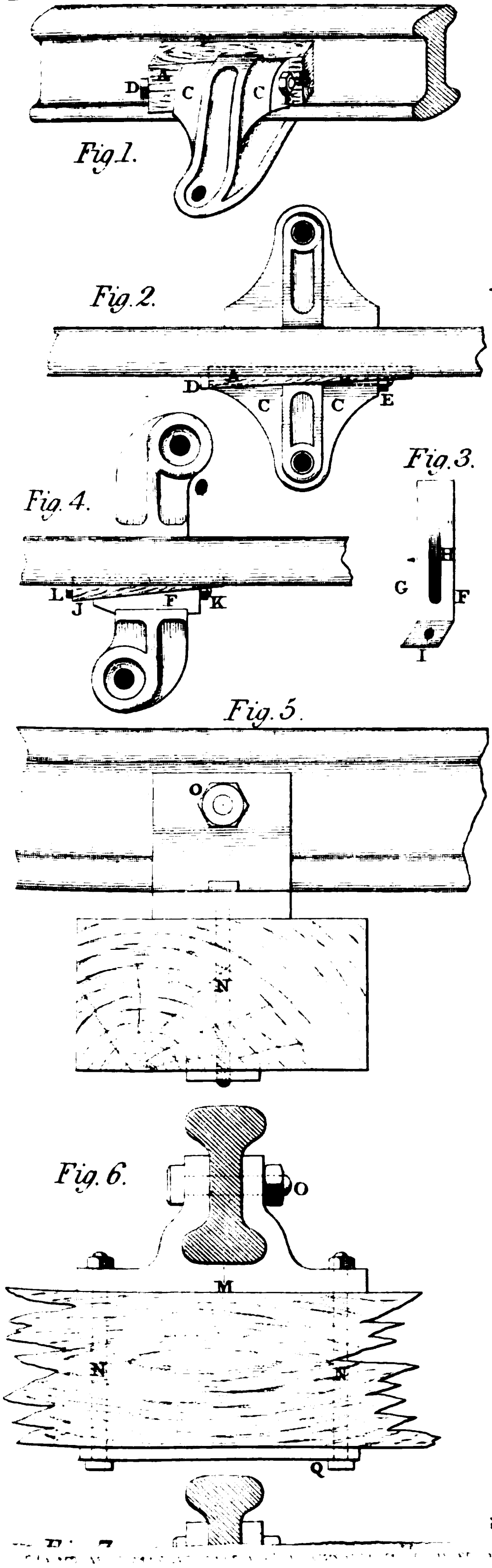
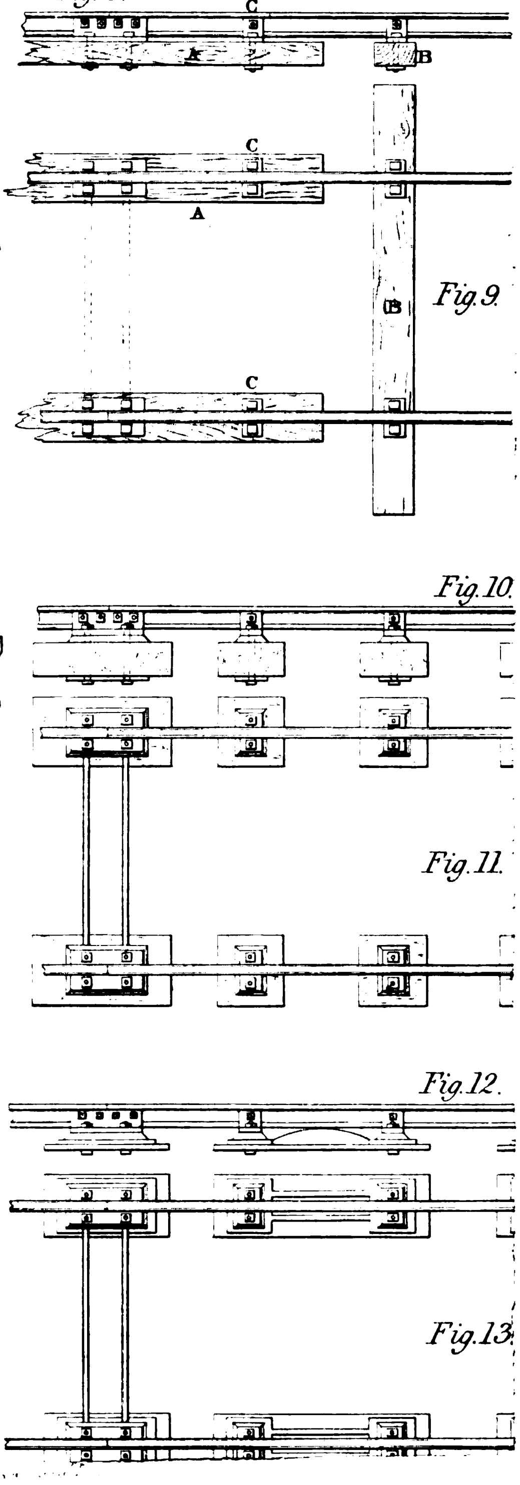


Fig. 8.



gummers having retreated, this movement is followed by the descent of a wetted sponge to moisten the flap, after which a dry gum cylinder "dredges" a thin film of powdered gum upon the moistened surface. The creasing table on which the blank is laid is of India-rubber, and is the most important feature of the machine, for by it the usual folding-box is dispensed with. The creaser is merely a rectangular box or frame, with sharp edges, the pressure of which upon the blank creases the latter to the proper shape, by entering into the yielding surface of the caoutchouc beneath, and thus the four flaps are bent upwards to a very considerable angle, just as the reader will find to occur on pressing the edge of a paper-cutter, or the back of a table-knife, upon a sheet of paper laid on a soft elastic surface. The flaps may then either be folded down by hand, or carried to a folding-table for completion. This transmission is effected by an ingenious arrangement of fingers or nippers, which grasp one of the projecting flaps, and traverses forward with it to the attendant's platform.

But a greater novelty still is the paper-bag machine, the performances of which we noticed in the *Practical Mechanic's Journal* for April last. The blanks are fed into a pair of horizontal rollers, which carry them forward and gum the parts for the junctions at the same time. From these rollers, the sheets are carried directly downwards by feeding tapes, as in steam-printing machinery. Each sheet is then pressed horizontally into a mould by means of a traversing core, and a series of arms and flaps then come into action, and complete the folding down. The folding case, or mould, then opens to release the core, which brings the bag away with it, and the core being then made to contract in diameter, allows the finished bag to drop off, on to a platform beneath. Not only are the bags well folded by this machine, but the shapes are great improvements upon existing bags, having full, square, round, or other flat bases, so as to stand open and upright of themselves.

Both these machines are in active and successful operation at Mr. Gathercole's paper-mill at Eltham.

COMBINED WOOD AND IRON SHIPS.

J. J. Brunet, *Canal Iron-Works, Poplar, London.—Enrolled July* 27, 1852.

This invention, which is the communicated improvement of M. Lucien Arman of Bourdeaux, resembles that of Mr. Jordan of Liverpool, in so far as it relates to the combined use of wood and iron in shipbuilding, whilst the details of the two plans are widely different. The object of this combination is the obtainment of the strength and lightness of iron vessels, without the liability to injury from shot, and the effects of fouling and corrosion, so objectionable in them at present. In building these ships, a very slight timber framing, with the timbers placed far asunder, is first erected, and secured in the ordinary manner to the keel. The kelson is of plate and angle iron, and is fastened between the timber framing and filling-up pieces; and a second framing of double angle iron, or iron rolled to the section of Messrs. Sutton and Ash's "water-space angle iron," is extended from the under part of the deck to the kelson. The ribs of this framing cross the timbers of the wooden framing at an angle of about 45°, and the wood and iron frames are secured together by bolts, the lower ends of the iron ribs being continued fore and aft, and connected to the kelson. When the distance from centre to centre of these ribs is considerable, filling-in pieces, of the same depth as the ribs, are introduced, and secured to the timber framing. When the diagonal iron frame is fastened, and riveted up with the iron kelson, shelf-pieces, and clamps, the outside planking is laid on in the usual manner. The whole of the wood and iron is then painted, and longitudinal iron strakes are bolted to the inner surface of the iron ribs. The strakes are either to be arranged so as to divide equally the distance between the clamps and floor, or lower futtock-heads of the timber framing, or so as to cover the entire area. If interstices are left between the iron strakes, both the iron and timber framework will be exposed, so that these parts may be inspected and repaired with great facility. This is an advantage of some importance in the new system, inasmuch as a leak may be discovered and put to rights without injury to the hull. To prevent the cargo from getting into such interstices, they are to be covered with moveable panels of wood or iron. This union of the two species of framing, allows of the use of the two kinds of fastenings peculiarly applicable to each; and the patentee argues with some reason, that his system combines the stiffness and substantiality of an iron-built ship, with the known advantages of a timber one coppered and copper-fastened.

ORNAMENTING METALS.

R. F. Sturges, *Birmingham.—Enrolled July* 24, 1852.

Mr. Sturges, the eminent metal manufacturer of Birmingham, has introduced a novel and most ingenious plan of ornamenting the metallic surfaces, in the production of which he has for many years been so distinguished. He takes a pattern sheet of paper, wire, or lace, and interposing it between two plates of metal, he at once transfers the device to the two plates.

Similarly, he ornaments a single plate by laying the matrix of the design upon it, and transferring the figure by mere pressure from a flat surface. Any metal may be thus treated, and whilst the process is of the simplest possible nature, it yet opens up an almost interminable variety of ornamental figuring.

LUBRICATING COMPOUNDS.

John Dennison *and* David Peel, *Halifax.—Enrolled August* 9, 1852.

In the preparation of wool for spinning, the raw material is treated, either before or after scouring, with a large quantity of oleaginous matter, in order to facilitate the after processes of manufacture, from teazing to spinning. This treatment adds considerably to the cost of manufacture, and it unfortunately happens that the coarsest and least valuable materials require the most oil, the greatest burden being thus imposed on the poorest branch of the manufacture. The present invention, of which Mr. John Dennison, of the extensive wool-manufacturing firm of John Dennison & Son of Halifax, is joint patentee, refers to the substitution of a cheap and more effective compound for the ordinary oleaginous mixtures, applicable as well for this especial purpose as for the lubrication of other materials and surfaces. The base of the new substance is sea-weed, kelp, or barilla, which is first boiled to a jelly. This jelly is drawn clear off, and whilst still warm, it has added to it a quantity of oil of any kind—the proportions being variable, according to the particular purpose in view—and the matters are then well mixed together. This compound is stated to cost, on an average, only one-half the price of oil, whilst it is better fitted for working the wool than the best oil alone.

Wool, rag-wool, or flocks, thus treated, are easier scribbled or spun than at present, and the glutinous nature of the jelly acts as "sizeing," so that the usual sizeing process is no longer necessary, and the fibres are greatly strengthened. The introduction of the process into the large woollen establishments of Yorkshire and the West of England, may be expected to lead to marked improvement in the trade.

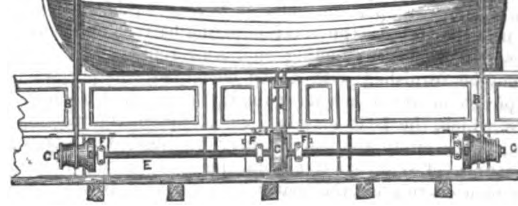
The Messrs. J. P. and G. F. Wilson, of the well-known Belmont Candle Works, have also just patented the application of oleic acid for the treatment of wool. They obtain the oleic acid from any distilled fatty acids, but more particularly from palm oil. It is obtained in a liquid state by subjection to a cold treatment, when the solid matter is separated by pressure, the fluid withdrawn being set to stand for the separation of whatever solid matter may be in suspension therein, and the acid is separated by washing in hot water.

SUSPENDING AND LOWERING SHIPS' BOATS.

W. Stirling Lacon, Esq., *Great Yarmouth.—Enrolled August* 23, 1852.

The essential peculiarities of Mr. Lacon's excellent system of managing ships' boats are already in the possession of our readers; but with the enrolment of the specification, we are now enabled to furnish details of the inventor's latest improvements. Past experience has shown us, with but too great severity, that however well appointed the boats may be in themselves, yet the slightest disarrangement or "hitch," in getting them safely lowered, will upset all preconceived plans, and turn the means of safety into a pitfall of destruction. It is rather too late to discover, as we have lately been doing, that a boat will not lower away properly—or, when lowered, that her plugs are gone, or fouled—on such

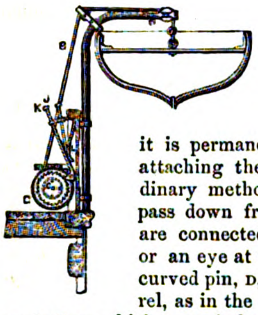
Fig. 1.



a dreadful emergency as the conflagration or foundering of the vessel. Such times are not exactly the best fitted for putting matters to rights. We must start fair, and keep a sharp look-out on our tackling—not leaving until to-morrow, when imminent danger may confront us, what may

be safely and properly done in the calms of to-day. Our movements and our mechanical apparatus must alike be systematized; and to such a desirable result does the present arrangement tend. Our illustration, fig. 1, represents a side elevation of a boat, as suspended from davits at the side of a ship, by Mr. Lacon; and fig. 2 is a cross section of the same.

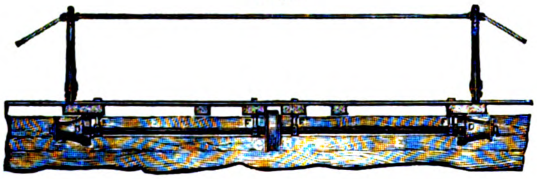
Fig. 2.



In these figures, A are two davits, or iron brackets, firmly secured to the bulwarks of the ship, and provided with sheaves, or friction pulleys, over which are passed the ropes or chains, B, for supporting the boat. The boat may be hoisted up at sea, if desirable, by means of the ordinary tackle; and when thus hoisted up, it is permanently retained in the desired position, by attaching the ropes or chains to the boat by the ordinary method now in use. The ropes or chains, B, pass down from the davits to conical barrels, C, and are connected thereto by the last link of the chain, or an eye at the extremity of the rope hooking on to a curved pin, D, projecting from the periphery of the barrel, as in the plan, fig. 3. These barrels are mounted on a shaft, E, which turns in bearings in the bracket pieces, F.

The barrels, C, are caused to rotate, by the means hereafter described, for the purpose of tightening the suspending chains or ropes, and causing

Fig. 3.



them to sustain the weight of the boat. The tackles before mentioned, as employed for hoisting up the boat, are then removed; at about the middle of its length, the shaft, E, carries a large friction pulley, G, to which a ratchet wheel, H, is affixed; and round the pulley is placed a friction strap, and the ends of the strap are jointed to a lever, J, which works on a fulcrum pin, just above the level of the shaft. Into the teeth of the ratchet wheel, a catch, projecting from a lever, K, which works on a pin, O, takes, for the purpose of preventing the running down of the chains or ropes by the rotation of the barrels; and this catch is kept forward in its place by means of a spring, L. The two levers are set fast by means of pins in a guide higher up; and these are readily disengaged, when the apparatus is to be brought into operation.

Let it now be understood that the boat, which has been raised to the position shown in the figures, is required to be lowered into the water. The seaman to whom this duty is assigned, first pulls forward the lever, J, in order to make the friction strap retain its hold upon the pulley, and thus prevent the premature revolution of the shaft, E. He then thrusts back the lever, K, and releases the catch from the teeth of the ratchet wheel, the lever end being kept back by means of its pin. On loosening the gripe of the friction strap, the boat will descend by its own gravity, and cause the chains or ropes to unwind from the barrels. When the boat has reached the water, the weight of the chains or ropes, if the shaft is still free to revolve, will pull round the barrels, until, by the slipping of the last link of each chain, or the eye at the end of the rope, from the projecting pin of its respective barrel, the ropes or chains fall away from the ship, and consequently free the boat from its connection with the ship. In order to prevent the boat from running down into the water too rapidly, it is only necessary for the seaman to keep the friction strap in contact with the pulley, by holding the lever, J, in its forward position; and thus any requisite amount of retardation may be put on the rotation of the barrels, and consequently on the descent of the suspending chains or ropes. If desirable, the shaft, E, may be furnished with a cog wheel, for the purpose of gearing into a pinion, mounted on a short shaft, provided with a winch-handle, by turning which, the boat may be hoisted up, or the winding of the suspending ropes on to the barrels may be effected, either when the ropes are connected to, or are free from, the boat; or the ordinary handspike may be used to raise the boat to its elevated position, instead of employing the tackles, as at present.

If rope pendants are used, small Flemish eyes must be worked at the ends of the rope, which are to be brought over the pins upon the barrels; or a piece of smaller rope, with an eye at the end, may be spliced on the end of each pendant. In using chains or ropes, there should be three or four extra turns upon the barrels when the boat reaches the water, to prevent the strain coming upon the eye and the pin, and to allow for the trim and the roll of the ship.*

These arrangements are precisely those adopted on board the South-Eastern and Continental Steam-Packet Co.'s steam-ships, *Queen of the Belgians* and *Princess Clementine*, from whose fittings our drawings have been taken.

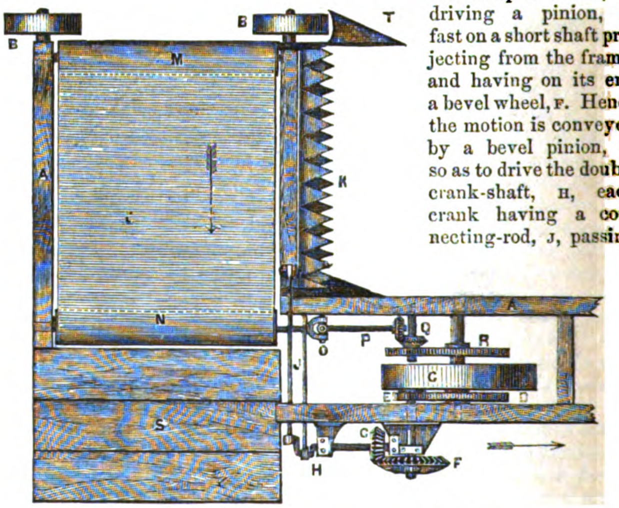
Some experiments were recently made on board the *Queen of the Belgians* at sea, with the wind blowing strong from the south-west, in the presence of Vice-Admiral Tucker, Capt. Hathorn, R.N., and a number of gentlemen connected with nautical affairs, when, in the first trial, the boat was lowered by a single man, and again hoisted with a couple of hands. In the second trial, a single hand lowered the boat with Mr. Lacon and three men in her, and cleared her from the ship, going at the rate of $12\frac{1}{2}$ knots an hour. Such trials are clearly demonstrative of the practical importance of the invention, and must sooner or later lead to its general introduction, both in the naval and mercantile marine.

REGISTERED DESIGNS.

REAPING MACHINE.

Registered for Messrs. W. Wray & Son, *Leeming, near Bedale.*

The marked success of M'Cormick's reaping machine, and the still greater performances of the Hussey machine, as improved by English mechanics, may well have caused agricultural improvers to look about them. Once on the track of practical improvement, we may look forward to good results from the attention now paid to this much neglected class of farming apparatus. Messrs. Wray's plan is amongst the latest additions to our increasing list of suggestions, and it certainly possesses superior claims as a mechanical arrangement of originally crude notions. Our engraving represents the machine in plan. It is built up from a timber framework, A, carried on the running wheels, B C. The cutters are actuated from the large front carrying wheel, C, the shaft of which carries a spur wheel, D, driving a pinion, E, fast on a short shaft projecting from the frame, and having on its end a bevel wheel, F. Hence the motion is conveyed by a bevel pinion, G, so as to drive the double crank-shaft, H, each crank having a connecting-rod, J, passing



across the frame to the two long transverse cutter blades, or knives, K. These knives slide horizontally on fixed guides, and being notched or serrated in the usual manner, they are so set, one above the other, that when at work, and moving in contrary directions, each serration acts as a pair of shears. Thus, as the machine travels forward against the standing grain, the cutting edges form their own abutment for the stalks during the severing action, and the stalks, cut exactly as they stand, fall back upon the endless travelling web, or carrier, L. This carrier cloth is extended over a pair of rollers, M N, and is made to travel continually at right angles to the path of the machine by the roller, N, the spindle of which is connected by a universal joint at O, with the shaft, P. The opposite end of this shaft is connected by a pair of bevel pinions, Q, and a pair of spur wheels, R, with the shaft of the running wheel, C. The carrier cloth travels in the direction of the arrow, and keeps up a stream of cut grain upon the delivery board, S, whence the grain is raked off by hand, whenever the accumulation amounts to the necessary quantity for a sheaf. At the front outside corner of the framing, a

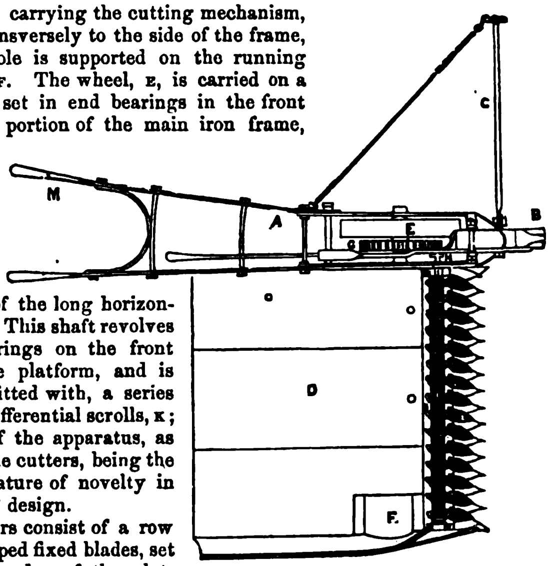
* There is also an arrangement on the barrels, by which, when chains are used, a sufficient length of log or signal line may be wound into a groove, the eye at one end being put over the pin, and the other end being attached to the last link of the chain, to prevent the chain, when it comes off the pin, unreeving by the run.

dividing iron, T, is fixed, for setting out the line of cut. The horses are harnessed to a pole attached to the narrow frame, in which the front runner, C, is set. This is by far the most ingenious plan of cutting action that we have ever seen. It appears to leave nothing to be desired as regards holding the stalks firm and steady for the cut, or, indeed, of cutting without the aid of any separate resisting surface.

REAPING MACHINE.

Registered for MR. WILLIAM HARKES, *Lostock, Cheshire.*

Since writing our notice of Messrs. Wray's machine, the annexed contrivance of Mr. Harkes has been laid before us. It is carried upon a species of plough framing, A, which has a front pole, B, and transverse stay, C, for the attachment of the horse. The platform, D, carrying the cutting mechanism, is bolted transversely to the side of the frame, and the whole is supported on the running wheels, E, F. The wheel, E, is carried on a short shaft, set in end bearings in the front rectangular portion of the main iron frame, and it has upon its shaft a spur wheel, G, actuating a pinion, H, fast on the inner end of the long horizontal shaft, J. This shaft revolves in end bearings on the front edge of the platform, and is formed, or fitted with, a series of cams or differential scrolls, K; this detail of the apparatus, as actuating the cutters, being the essential feature of novelty in Mr. Harkes' design.



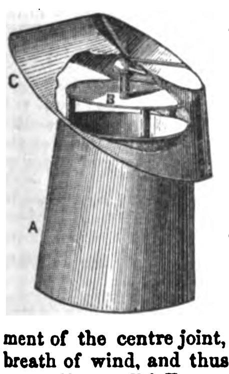
The cutters consist of a row of spear-shaped fixed blades, set on the front edge of the platform, so as to travel along at a uniform height from the ground. The front projecting ends of these cutters are pointed so as to effect the easy division of the standing grain for the passage through and cut of the machine; and each cutter is caused to act as a duplex shears, by the addition of the row of oscillating cutters, L. These cutters are set immediately over the fixed ones, each one turning upon a stud centre of its own, and having a back notch in its plate for the entry therein of the corresponding revolving cam, K, of the shaft, J, behind. Then, as the machine proceeds, the revolution of these cams gives a quick reciprocatory movement to the cutters, L, which, like those beneath them, are double-edged, to cut both ways.

The machine is guided, and its height of cut regulated, by the stilts or plough handles, M; and as the corn is severed, it falls back on the platform, D, whence it is carried off by a self-acting rake, since added by the inventor, to clear the machine, without the necessity of an attendant to follow. The whole details are well arranged, and the cut is given in the most effective manner, whilst the gearing is eminently simple.

VENTILATING WIND-GUARD.

Registered for M. A. SUTER, *Fenchurch Street, London.*

Our illustration of this last new form of wind-guard so clearly explains its construction, as to render our description almost unnecessary. The barrel, A, terminating the flue, has attached, at a short distance above its open upper end, a flat disc, B, so as to leave an annular discharge aperture for the smoke. In the centre of this disc is a short stud, carrying a universal joint on its top, for the purpose of supporting an adjustable open-topped deflector, or saucer-shaped shield, C, part of which is here broken away to show the joint inside. The figure shows its behaviour under the action of a side wind, when it affords a very good shield for the windward side, and a very clear smoke passage on the lee. A great point in this contrivance is the arrangement of the centre joint, which allows the shield to turn with the least breath of wind, and thus afford a constant screen.



GOLD WASHER AND RESERVER.

Registered for MESSRS. HILL & SONS, *Cowper Street, City Road.*

The "diggins" mania has at least had a good effect in finding plenty of occupation for certain classes of machinists; and cradles, gold-washers, stampers, and crushers, have all at once monopolised the labours of a large proportion of our industrial population.

Messrs. Hill's machine is contrived, as well to wash the auriferous earth, as to "reserve" or detain its more precious constituents. Externally, it resembles an ordinary seaman's chest. It has within it a perforated metal diaphragm, forming an upper receiver, into which the earth is first thrown for agitation with water. From this division, the smaller particles pass off to a sieve; after passing through which, the earthy particles are discharged, whilst the gold, in larger or smaller pieces, is caught by the coarser or finer diaphragms. Whatever gold passes through the finest sieve, may be caught by drawing off the bottom sediment through a flexible tube into a detached sieve of very fine meshes. To aid in the disintegration of the matter, and to secure a perfect washing action in every part, the bottom of the chest is rounded or rocker-like, so that the rocking motion dashes the water very effectively over the mass under treatment. The apparatus is simple and cheap, and its entire fittings may be packed inside it, still leaving available space for the purposes of a sea-chest.

REVIEWS OF NEW BOOKS.

A TREATISE ON THE SCREW PROPELLER. By John Bourne, C.E. Steel Plates and Woodcuts. London: Longman, Brown, Green, and Longmans. 1851. Part I.

This must be considered a work of great promise, if we are to take the author's word for it, as put forth in his characteristic self-satisfied language on the cover. "Mr. Bourne proposes to produce a work upon the screw propeller, which, deriving its doctrines, not from theoretical speculations, but from the results of numerous experiments carefully performed, and from the experience afforded by screw vessels in the ordinary routine of commercial operation, shall, if failing to illustrate the whole subject, at least communicate as much as is at present known respecting it. . . . . And being carefully freed from the erroneous statements, strained inferences, and groundless hypotheses, which are often to be found in scientific works—and which constitute a most baneful adulteration—the doctrines put forth will not subsequently have to be unlearned, but may be accepted with corresponding confidence."

Mr. Bourne, of course, commences with a historical account of the various expedients which have been proposed for the propulsion of vessels on what may be termed the screw principle. After very properly giving a greater share of praise to those scientific labourers, who have practically worked out and realised a great mechanical idea, such as is involved in the subject on which he writes, rather than to the mere ideal originators thereof, he proceeds to abstract nearly all their merit from the more modern portion of the latter class, by referring the birth of the idea to a very remote period, telling us that "the idea of making a screw on the plan of a windmill, to work in water, appears to have originated with Robert Hooke," in the seventeenth century.

We must confess, however, that this is not as evident to us as it seems to be to the author. He describes a species of horizontal windmill, the vanes or sails of which are made to feather after the manner of the floats of a modern paddle-wheel, adding, that the plan would be very convenient for watermills in particular situations. This is nothing but a modification suitable for a common water-wheel; and we do not exactly perceive how it shows, that with Hooke originated the idea of a *screw*, on the plan of a windmill, to work in water. With most other mechanical arrangements, it is difficult to fix the time of the first invention. The first symptom of an idea on the subject requires an effort of the imagination to classify it as such, but by-and-by it emerges from vagueness and obscurity, and becomes at last a substantial fact. This will be very apparent to the reader of this history. In the first attempts to use a screw in water, the water was made to give motion to the screw; and a century seems to have elapsed before the idea of making the screw act on the water was suggested to any one, though to us the latter seems so naturally to follow the former.

We have few more observations to make; for it is difficult to judge of the *tout ensemble* of a structure, of which only a single stone, and that of the foundation, and necessarily less elaborated, is given us for our opinion. The specimens of the plates and woodcuts are unexceptionable; and, as if to show us that he has not lost his predilection for them, Mr. Bourne commences, in this part, an appendix, containing elaborate tables of the dimensions and performance of screw vessels.

Philosophical Instruments and Processes as represented in the Great Exhibition. By James Glaisher, Esq., F.R.S. Bogue, London. 1852.

Economy of labour is one of the prime conditions of advance. It must have been so in all time; for it is impossible to conceive a state of society in which many examples of such economical arrangements do not exist. The common fishing tackle, the simple hunting spear, is each but an instance of the great desideratum which man has aimed at and attained. The rudest tool of the mechanic, shares, in this respect, a common brotherhood with the savage and the most civilized life. For the most ingeniously constructed, and least imperfect philosophical instrument known, is but a tool of a superior description applicable to purposes of higher kinds. And what are processes, philosophically considered? Surely nothing except means, or moral tools, by which we teach ourselves to arrive at ends, and perform operations with lessened toil. From the high position upon which we stand, and into which—as regards the point to which our present attention is directed—we have insensibly grown from our earliest years, we are apt to forget many plain truths of this kind, and to surround ourselves, in the midst of our intellectual wealth, with an obscurity as impenetrable from without as it is from within, and through which no way of approach to or from the lower world appears. The mechanic and the philosopher stand out as aphorisms, isolated one from the other as the known and unknown quantities in algebra; and yet, if we cast but only one little ray of historic light over them, how truly and naturally—nay, indissolubly—connected are they found to be!

These preliminary remarks have been called forth from an undercurrent of thought which is perceptible in Mr. Glaisher's present discourse, and which we shall have occasion to touch upon again by-and-by.

To no person could have been intrusted the arduous task of comment upon the important matters discussed, with a better founded hope that they would receive due attention; and the author has performed his task with both singular industry and skill. By having been selected joint reporter with Sir David Brewster on the instruments and processes exhibited, he obtained facilities for acquiring the information, while it has never fallen to our lot to be able to notice how more accurately and pleasantly the information acquired has been imparted in so concise a form. We must endeavour to touch upon the principal subjects discussed, leaving our readers—in a pamphlet, treated, as this is, in so analytical a manner—to roam more at large in the publication itself.

It is somewhat startling to be informed that the instruments, as collected, did not truly represent the existing state of science. Thus, as regards the chief among the philosophical instruments—viz., those connected with astronomy—Germany did not put forth any of her strength, while not one single instrument of the kind was exhibited by France, and one large instrument only (the Equatorial, by Ross) was made to represent our own national advances. While on the subject of astronomical instruments, we strongly recommend our ingenious readers to refer to the present printed discourse, for a description of a Transit instrument of very novel construction, by W. Bond & Son, of the United States, and which is eminently suggestive of many entirely new applications of the galvanic battery. Another description of the same instrument will be found in the "Reports of Juries," p. 251. Of nautical instruments, Belgium furnished several, which were good in all respects; and it is gratifying to find that Russia sent the two largest in the Exhibition, both well made. Mr. Glaisher authoritatively informs us, that of ordinary practical instruments, the American department furnished a fine collection, by Ericsson, mostly of a new construction; also a very ingenious compass, by St. John. The peculiarity of the latter instrument consists in the addition of two small magnets, moving freely upon fine points attached to the compass-card, near its E. and W. extremities. To the centre of each small magnet, and at right angles to it, is placed a brass indicator, which points *to* the centre of the card when not under the influence of disturbance, and *from* the centre at other times. The deviation from the centre indicates the amount of disturbance, which, if local, is shown by the one of these indicators pointing further from the centre than the other. The amount of these deflections is measured by semicircular scales fixed over the centre of the card. Russia furnished, it appears, a well-made levelling instrument; and America an instrument well adapted for surveying new countries, particularly in magnetic districts.

After what the Exhibition has already taught us, it is by no means startling to be informed that meteorological instruments should, in their conditions, be better understood abroad than at home.

The importance of good glasses to the philosophical instrument-maker is obvious in all cases in which glass is used. Until comparatively recent times, the manufacture had not received any due share of attention; and this has been so far the case, as for anything new of the kind to be regarded with high interest. It was this which attracted attention to the new kind of glass exhibited by Maes (France); its base composed of the oxide of zinc and borax, and which was extremely clear and free from colour, and promises, as Mr. Glaisher says, "to be of considerable use in producing achromatic object-glasses of a rare description." The Exhibition, as he continues, also made known a very fair attempt, by Wray (United Kingdom), to substitute a solid substance instead of flint glass, which, as a step out of the beaten path, and towards the possible revival of fluid object-glasses, is meritorious. Ross, likewise, exhibited a small object-glass, which was very good. The noble piece of glass exhibited by Chance, no less than 29 inches in diameter, and weighing 200 pounds, was deserving of attention.

The subject of glass brings us to the consideration of lighthouses. Chance and Wilkins each exhibited one entirely of glass, and which are well-remembered objects in the western nave; and to microscopes, the established pre-eminence in which now belongs, admittedly, to the United Kingdom. A somewhat curious improvement is also likely to take place in spectacles for the eyes. We often hear, perhaps ourselves experience, how always, or at times, one eye appears of greater or less power than the other. This no doubt arises from malformation produced by some means or another, or possibly congenital. "I did not know one optician in London to whom I could refer any one so afflicted with any chance of relief," says the author; and now that the fact has been thus stated, hundreds will admit the same truth. Mr. Simms, it appears, has paid some attention to this interesting desideratum, and no doubt the public (for it is a public) want will be shortly supplied.

The American daguerreotypes, of course, pass under review, and the specimens exhibited were remarkable illustrations of the excellence of the known processes employed in their production. They consisted, as it will be remembered, almost entirely of portraits, and were distinguished by a depth and harmony of tone quite unsurpassed by those of other nations.

Mr. Owen's calotypes deserved and receives especial notice. The paper used by him is his own invention, and "he has been enabled to execute, in a single day, in a journey of 300 miles, ten large-sized pictures."

Mr. Glaisher condescends to notice the pretty curiosity of the Iridescent Films exhibited by Mr. De la Rue. It is, as the former says, a beautiful illustration of the production of colour on a thin transparent surface by the agency of light, the colours being as bright as those seen transiently in the soap bubble. The process, we are told, is performed by dropping a small quantity of spirit-varnish upon the surface of water when tranquil, which, spreading in all directions, becomes exceedingly attenuated, and reflects the colours of the spectrum. The object immersed (the paper-hanging, the card-case, &c.) is then raised slowly, in such manner that the film adheres to the surface. It is, of course, applicable to a variety of ornamental purposes.

Notwithstanding the excitement afforded by the Exhibition, when as yet in embryo, to persons who are of that order which never rests satisfied with things as they are, and notwithstanding the numerous beautiful and well-finished examples of the minor philosophical instruments, we were struck with the truth to which Mr. Glaisher has adverted, as to the general state of this kind of science being really unrepresented. The glorious achievements of the ingeniously-contrived self-recording instruments point to very high future progress indeed; and it will be the fault of our philosophical instrument-makers, if they do not meet what men are beginning to look for in the place of wondering at. Mr. Glaisher has a remark upon this subject, which we must extract:—

"The steps in the progress of science, however, are, though numerous, so small, and pass by so unperceived, that insensibly we are not led to wonder at that which, some years back, would have been considered a miracle; in illustration of which are the means of locomotion now at our command through the application of steam power; the instantaneous communication between place and place, even to the connecting our own island with the continent, through the agency of electricity; the discovery of electro-magnetism, and its subsequent applications; the discovery of photography, and its application to the purposes of astronomical science, and to the self-registration of natural phenomena, which, all unthought of a few years ago, but now in full activity, create no feeling other than that of admiration at the vast resources so gradually and surely unfolding to us; and when we pause to consider that the constituents of a great nation's prosperity—agriculture, manufactures, and commerce, *in their excellence*, are dependent upon science, the first upon chemistry, the second upon mechanics, the third upon navigation (itself dependent upon astronomy), we see that the repayment made by it to the sources of its establishment, puts nations in possession of an element which, according to the culture bestowed upon it, is capable of conferring wealth, prosperity, and power."

Mr. Glaisher, in another place, refers to some of the means to attain these ends, as follows:—

"In by-gone times, man knew no substitute for the replacement of manual exertion; work with the hammer required the employment of men, in whom muscular strength was the only capital invested; this was superseded by a knowledge of mechanics—the law of forces, which compelled the weight to descend unerringly at

the appointed time. Now a higher agent still is called into play, and the galvanic current—a stream, subtle, imperceptible, and instantaneous—is made to endue the ponderous iron with a still more unerring precision; and, more important still, is found linked with a power, that of magnetism, upon which other agents of nature, light and chemistry, are at work to supply materials to enable us to elucidate laws; and electro-magnetism, while supplying us with a new motive power, gives us a means of handling the unknown power, and permits us to add experiments and practice to the slow process of accumulating observations."

We cordially agree with what the writer advances respecting the absolute necessity of a better direction of industry, in order to meet its highest reward. This can best be attained by honest self-education of the man of industry. He is then in a position of advance, when he feels conscious of the union in himself of both theory and practice; and what is thus true of the individual, is true of his class. To the great expediency of such union between the philosophical theorist and the practical mechanic or artisan, Mr. Glaisher, as we might expect, brings the weight of his authority; and having attained honour himself, he hesitates not to arrogate to general science honours due as of its right, and warmly and wisely to claim for its laborious prosecutors other due national rewards.

On the Propulsion of Vessels by the Screw. By R. Bodmer, C.E. London: John Weale. 1852. Pp. 16.

With a title that would do very well for a work extending to a volume or two—and the subject contains within itself quite enough matter for such extension—we have here a short chapter, comprising simply a rule for computing certain dimensions of a screw propeller, so that, with given dimensions, &c., of the vessel and engines, the most effective proportions may be ascertained. We therefore presume that Mr. Bodmer considers the whole subject as contained in that "nutshell."

Mr. Bodmer commences by calculating the "circle of gyration," in which lies the point where the resistance may be said to be concentrated. In the case of a propeller whose blades form portions of a *true* screw, this seems to us unnecessary; for though at any distance from that circle, the angle of inclination, or, in other words, the pitch, as compared with the diameter, is less or greater as we recede from, or approach to, the axis; yet the difference is compensated for, by the greater or less space passed through in the same time, and the greater or less length of the circumference; consequently, the terms derived from the circle of gyration, and employed in Mr. Bodmer's subsequent formulæ, might be calculated equally well from the external edge of the blade, or from a circle taken at any distance from the axis. Of course, with a screw of differential pitch, we must adopt some such means as that proposed by Mr. Bodmer.

According to a table given in his last page, Mr. Bodmer makes the results of his calculations come pretty near to actual experiment; but to accomplish this, he employs a certain coefficient (Δ) in his formula. On the first introduction of this, we are promised an explanation further on; but all we can find is, that "it is most likely, owing to the circumstance that the blade of the screw, instead of terminating abruptly towards the axis, as it does at the circumference and sides, merges into the boss, which must have a tendency to diminish the resistance produced by its rotation in the water." This is very unsatisfactory; to us it appears that it might, perhaps, be better explained by attributing it to the yielding of the water.

On the whole, we consider Mr. Bodmer's rule as correct in principle —for determining the dimensions of the screw when the *engines* are given; but although, with an engine of particular proportions, a screw of a certain form will answer best, there is nothing to do away with the possibility that an engine might be constructed of *other* proportions, and of course with a different screw, and so give *better* results at a like cost. In other words, Mr. Bodmer's rule is good as far as it goes; but it does not go far enough.

If the blades of a screw lay in a plane passing through the axis, their revolution would not propel the vessel, though great power would be expended; on the other hand, neither would they propel the vessel if they lay in a plane at right angles to the axis. May we, then, not hazard the suggestion, that the propulsive power would be most effective were the *average* angle of inclination of the blades midway between these two positions, and that the best combination of engines and screw would be that in which the proportions of the former were such, that, according to Mr. Bodmer's formulæ, if correct, the blades of the latter should have an average inclination of 45°; at any rate, we would, if possible, calculate the proportions of the engines from the screw, and not the screw from the engines.

The best form of screw may not be one with an average inclination of 45°; there must, however, be *one best* form, and, when ascertained, the engines should be proportioned accordingly.

The results produced by Mr. Bodmer's formulæ depend very much on a term employed to represent the resistance of the ship. This resistance is variable in the same ship, according to the immersion and the velocity; so that, after all, a screw of a fixed proportion is not the best for the same ship under all circumstances, and more especially with varying degrees of assistance from the wind. Indeed all the experience of screw propulsion, during the last few years, tends to show the necessity of a capability of *accommodation* in the screw, if the best results are to be obtained under varying circumstances. To effect this, the blades must be made to swivel, being so formed that the action of the water may give them the proper twist, and having adjustable springs so set, as to give them a constant tendency to resume their normal position. It is questionable, however, whether the mechanical contrivances necessary to accomplish this would not involve disadvantages, which would more than compensate for the gain following their adoption. We leave the problem to the ingenious contriver. It is possible that, when what is wanted is known, some means may be found to attain the desired end without counteracting accompaniments.

Mr. Bodmer's work has been carefully and laboriously executed; but it is not to be approached by any mere general reader, who would enter upon it but to find himself involved in a maze, to be threaded only by the special student.

Reports of the Juries on the Subjects of the Thirty Classes into which the Great Exhibition was Divided. London, 1852.

In whatever light we may regard this performance, it is impossible to turn away from a glance at it without some sentiment akin to wonder and admiration. We all know how the great Napoleon thrust the glory of the passage of the Alps before the imagination of every private in his army; and when we reflect how many persons have contributed to the production of this work, in the form in which it now lies before us, we are tempted by the magnitude, physical and moral, of the result, to ascribe far more than a due share of honour to every individual having a hand or a thought about its compilation and completion. Had we the requisite leisure, it would be our delight to wade through it column by column, and not miss one line. If it were our fortune to be in the Senate, there is not one page throughout the whole but what should receive, as it claims, very deep consideration; while many, too many of the pages, we regret to say, afford matter to a British subject for grave consideration and much anxiety. Styled, simply, "Reports of the Juries on the Subjects in the Thirty Classes into which the Exhibition was Divided," it by no means conveys to the mind an adequate notion of its real contents. For all the reports, except two or three, form elaborate essays upon the subjects to which they relate; treating those subjects historically and statistically, never without evidence of great care, and often embellished with the graces of better writing. We have, in truth, in this volume—not a small one, certainly, but still not so large a one as might have been framed with less care—a complete encyclopædia of art-manufacture—a book which our Manchester men, and our Glasgow men, and our Birmingham men, will do well to do all but "get by heart."

It commences with the report of Viscount Canning, President of the Council of the Chairmen of Juries, on presenting the awards of the Juries of the Royal Commission, with the answer of His Royal Highness Prince Albert. Between the two are given the decisions regarding the juries, a classification of the subjects in the thirty classes into which the Exhibition was divided, the instructions of the Council of Chairmen to the juries, the minute of the Royal Commission on the award of the Council Medal, the names of the special commissioners in charge of the department of juries and deputies, the names of the Council of Chairmen, lists of jurors and associate jurors, also exhibitors of jury awards of the Council Medal, Prize Medal, Honourable Mention, and here and there money rewards—the list of jury awards occupying no less than eighty-five closely-printed small folio pages! The reports follow; and the whole is very conveniently and properly completed by an elaborate lexicographical index, of 117 double-columned pages, which is so fair an example of what an index in general should be, that we recommend it to the careful study of a certain person in our great national library, feeling persuaded that very many beneficial suggestions are to be obtained from it. We do not know to whom the care of compiling the index was intrusted; but to whomsoever it was, the thanks of all parties are due. We have handled the volume a good deal; and in often consulting the index, we have never been at fault. It is the best praise to declare a thing to have performed a duty which it was required to perform. Besides this index, several of the reports have special indices, which yet more materially assist the student. We would particularly notice that to the report on Class X., which, however, is rather a synopsis than an index, but is well prepared.

We have been careful to give to our readers, above, some accurate

notion of what they may expect to meet with in *this* book of reports, and this detail has encroached so much upon our space, as to compel us to defer to our next part our first notice of some of the reports themselves. We would, however, in the meantime, strongly recommend every one in any way connected with art-manufacture and mechanism, to make intimate acquaintance with the volume. Few, it would seem, will find this difficult to accomplish, as it is given out that the number of exhibitors was about 17,000, and that the Royal Commissioners intend to present each of them with a copy of the reports; so that a good "circulation" is insured, and the reports, like the prize medals and "honourable mentions," will be literally (taking a simile from the fields through which, within this hour, we have been straying) as plentiful as blackberries.

Atmosphere; a Philosophical Work. By George Woodhead, Esq. Balliere, London. 1852. Pp. 146.

A philosophical work on the atmosphere, in these days, and contained in less than 150 pages, each one comprising scarcely "a rivulet of type in a large meadow of margin!" What next?

The readers of the Mechanic's Magazine will probably remember a series of papers on the same subject, some of which have appeared from time to time as letters addressed to the Editor, under the signature "W." and "G." The present work is a reprint of these papers, arranged under sixteen heads; and the author seems so earnest in the matter, and so convinced of the great truth to which he would point, as to bring the subject down to the very lowest capacity, by filling several pages with notes explaining the construction of the simplest instruments of observation—such as the thermometer, barometer, air-pump, galvanic battery, gas apparatus, &c., with diagrams (among which is a drawing of an air balloon!) It was said by some one, that a fool very often advances in three words a proposition which it would take a wise man volumes to refute. We are of those, however, who think a great book a great evil, and have experienced often even one word in season how good it is.

The theory which the present pages would advocate is an ambitious one, and revolutionary to many ancient notions. It was a portion of school learning, to be convinced that there is no heat in fire; but philosophers have always retained some obscure idea, that there is in nature some such a *principle* as heat itself. The present author would treat heat as an effect only, and not a cause—an effect produced simply by light and pressure of the atmosphere. He has collected together several experiments, the results of which may or may not, precisely as they are viewed, tend to support or destroy his position, and the experiments have in general the important characteristic of suggestiveness. It would not be difficult to devise many others differing from those he has recorded; and parties taking interest in the subject will do well to act upon the suggestions they supply. Some of his conclusions are, however, amusing enough, and probably something of the kind is inseparable from an original thinker laying down, for the first time, some broad general idea. He begins the first chapter, rather abruptly, it must be confessed, with the following question:—"Is not the agitation of boiling water caused by air *which enters through the bottom of the vessel*; and which, rising up through the water, causes the bubbling called boiling?" He tells us authoritatively in other places, that "the expansion of heated bodies is caused by air that has entered them; which, when they cool and contract, they give out, or squeeze out," p. 11. "Light and air, in producing the effects ascribed to heat, *seem* to act after this manner:—The light *appears* to penetrate bodies, and to make way for the admission of air into them; and then, when the light is sufficiently concentrated, the matter or particles composing bodies are thereby separated and set at liberty, and the appearances called combustion and melting are produced," p. 11. The fire which appears in the connecting wire of the galvanic battery, in an exhausted receiver, "is caused by *the* two streams of aeriform fluid which come from the battery, pass through the conducting wire, and there, by their confluence and the pressure arising from it, produce the fire perceived." Notwithstanding such an *un*philosophical style, and the multitude of unnecessary repetitions even in the limited quantity of matter, there is certainly something to be gained, as we have already hinted, from the suggestiveness of the little volume.

We give below an extract of the whole of Chapter XIII., on the construction of steam boilers:—

"Convinced that the explosions incident to steam boilers are caused by the pressure of the elastic fluid within the boiler, and that such of them as happen at the starting of the engine, and letting off the steam, originate in the sudden and unequal contraction of the boiler, consequent on the issue of steam from it at a time when it is in a state of extreme tension, allow me to suggest, in the pages of your valuable Magazine, that the pipes or tubes through which the steam passes to the piston of the engine, and to the safety valve, should be carried eight or ten inches into the interior of the boiler, so that when the steam is put on the engine, or let off at the safety valve, the draught may be from the centre, or at all events from the interior of the mass of elastic fluid in the boiler, instead of from the side; and thus the contraction, resulting from the issue of the steam, will be distributed more equally throughout the boiler, instead of being confined, as at present, to one place.

"A boiler on this construction would, I think, be secure from those explosions to which boilers are liable at the starting of the engine, and the sudden letting off of the steam, without having its efficiency impaired."

We hope the reader has not been exhausted by the lengthy single sentence which we have above first extracted. Such a work as this loses much of its just merit by the want of care in its compilation. The printing and "getting up" deserved a better arrangement of the contents.

Her Majesty's Screw Frigate "Dauntless." Lithographed by T. G. Dutton, from a Drawing by St. George C. S. Davis, Engineer, R.N.

This is a very spirited, as well as faithful, representation of a vessel whose appearance and performances must be familiar to many of the readers of the *Practical Mechanic's Journal*. She is depicted as under storm canvas, in a pretty stiff breeze, and spreading only a close-reefed topsail, fore staysail, and spanker, with the wind on her port-bow. In dock, as a mere steam frigate, the *Dauntless* had a heavy, stiff look; but, as a sailing vessel, Mr. Davis, without unduly flattering her actual build, has shown off his ship to all the advantage which the accessories of a rolling sea, bent canvas, and the poetry of seeming motion, can afford.

The artist, who is one of the engineers of the vessel, shows himself to be a clever draughtsman; and his endeavours have been ably seconded by the tinted lithographing of Mr. Dutton. The size of the plate is 16 inches by 10½.

Elements of Practical Geometry for Schools and Workmen. London: Groombridge & Sons. Woodcuts. Pp. 96. 1852.

This little book, by the author of "Arithmetic for Young Children," "Exercises for the Senses," and "Drawing for Young Children," is designed for a class of students somewhat more advanced, namely, "for young workmen, and for the older pupils in schools where theoretical geometry is not taught."

The author goes on to say, that "it explains only the most simple and useful facts and operations which every person ought to know," and, we are glad to add, in a very efficient and intelligent manner. "A great part of it does not require a knowledge even of arithmetic; and no kind of explanation has been used that is likely to be found difficult by a beginner."

We almost envy the rising generation—our successors at school—the facilities now afforded them, the pleasantness of the way, and the absence of frowning portals, requiring the "master-key of genius, or crowbar of industry," to pass them, and get into the domain of wisdom and science. In the class of books written to render the tyro's first steps in science less difficult and uncertain, we have seen few that appear so well adapted to this end as the one before us. The elucidations are remarkably distinct, quaint, and intelligible; and every proposition has a tendency to fix itself in the memory, being illustrated by applications so manifest, so near at hand, and of such constant and every-day occurrence. The arrangement and classification are fairly managed, the diagrams are copious and distinct, and the terms are generally well chosen and defined, though such as "solid geometry" and "plane geometry," instead of "geometry of the solid" or "plane," ought not to satisfy the careful critic. The book is, besides, neatly and attractively got up.

CORRESPONDENCE.

MINE VENTILATION BY THE FAN-BLAST.

The publication of Mr. Nasmyth's plan of ventilating mines by the fan-blast, shows how narrowly I have been anticipated in my views on this subject; for, whilst I wrote my notes upon it, Mr. Nasmyth was successfully employed in the production of aerial circulation in one of Earl Fitzwilliam's pits. Our plans are, however, not precisely identical—as Mr. Nasmyth places his fan at the top of the upcast shaft, whilst I have arranged mine for the bottom; so that, whenever the indicator points out any derangement of the air-courses, the attendant in charge, being close to the scene of action, would be able to remedy the defect at once. In Mr. Nasmyth's plan, time would be lost in communicating between the surface and the bottom of the shaft. The indicator might be made to show the number of thousands of cubic feet of air supplied to the mine per minute, as well as the rate of the current, in lineal feet, per second.

Alfred, New Town, Kent, August, 1852.

William Thorburn.

MORTON'S RADIATING CYLINDER ENGINE.

In this engine—which I have recently contrived—the distinguishing peculiarity is, that the crank is acted upon perpendicularly, or nearly so, all the way round, a point which I consider to be of great value. Fig. 1 is a side elevation of the engine, and fig. 2 a plan corresponding. The cylinder, A, oscillates radially on a vertical axis—that is, the axis of motion is in a line parallel to the axis of the cylinder itself. The upper trunnion works in the plummer block, B, cast on the side of the main framing; whilst the corresponding lower block is cast on the foundation plate at C. The steam enters by the branch at D, passing through the upper trunnion by a joint in the usual manner, into the intermediate steam-chest, E, between the two trunnions. The valves are common cored slides, and the exhaust from the cylinder is through the hollow of the slide, and thence through the lower trunnion, to the condenser pipe, F. The slide-valve rod, passing up through the overhead steam-pipe, is directly attached to a frame eccentric motion, G, to work the spindle vertically. The entablature, or spring beam, H, is secured at each end in the wall on each side the engine. To allow of the varying horizontal distance of the cylinder's axis from the face of the crank, the piston connecting-rod, J, is spherically jointed to the crank-pin, and it works freely through the trunk, K, the lower end of the rod being, of course, similarly jointed to the bottom of the trunk. The bearings might be made on Schiele's anti-friction curve principle.

Fig. 1.

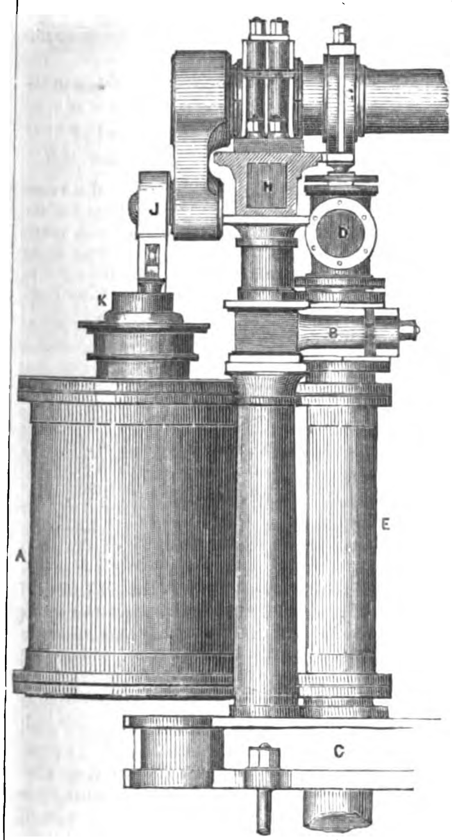
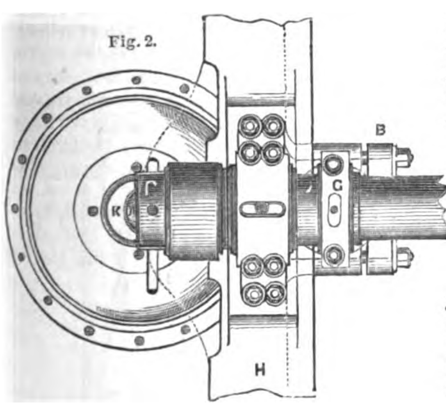


Fig. 2.



ALEX. MORTON.

Dundee, August, 1852.

[This engine is really a great curiosity; for it involves a modified compound of the trunk and oscillating principles, and yet it is neither the one nor the other. Mr. Morton does, indeed, secure a nearly vertical direct action throughout the path of the crank, as the cylinder follows the horizontal position of the crank-pin from side to side. But he accomplishes this at the expense of considerable overhanging strain, owing to the distance of the axis of the cylinder from its one-sided centre of motion, in addition to the necessity for the use of the trunk; and, lastly, the system of universal joints for the connecting-rod.—ED. P. M. JOURNAL.]

WHITELAW'S STEAM-ENGINE IMPROVEMENTS.

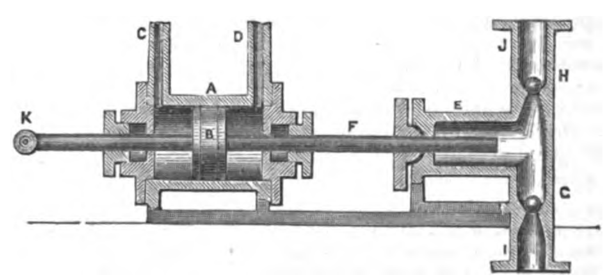
I formed a very favourable opinion of these improvements, from the description in the July number of your excellent *Journal*. This opinion was not reversed by the strictures of your Derby correspondent in the August number; but, on the contrary, confirmed on a further examination of the matter, to which I was thereby induced; and I think it is a question whether "the first general principles of mechanics" are better understood by your Derby correspondent, than by Mr. Whitelaw, or the able writer of the descriptive article.

The question of the unequally-divided beam is pretty much one of friction, which your correspondent seems to have overlooked in framing his remarks. I will endeavour to make this evident, taking for illustration a 20-horse power engine, of Boulton and Watt's proportions, wherein the stroke is 5 feet, crank 30 inches long, crank-pin 4¼ inches, and crank-shaft journals 7½ inches in diameter. Calculating the loss of power by friction, on the crank-pin and first crank-shaft journal bearings, by the rule given in your July number, I find it to be 4 per cent. of the whole power transmitted by the connecting-rod. Let us now suppose the connecting-rod to be jointed to the beam at a point so near the centre thereof, that the length of the crank would have to be reduced to 7½ inches, or one-fourth of the usual proportion. In this case the diameter of the crank-pin would have to be doubled, and, according to the above-mentioned rule, a loss of 21 per cent. would be the result. If the connecting-rod be brought still nearer the centre of the beam, so that, for instance, a crank $\frac{1}{16}$th of the usual length would be required, the loss will be much more striking; but if nothing else were to be considered but "the first general principles," seemingly understood by your correspondent, this loss should not exist. There would be, moreover, other disadvantages attending engines proportioned as above, such as the necessarily increased size of the main centre gudgeons, and of the top bearings of the connecting-rod, as well as the increased pressure on all these parts. After what has been said in reference to bringing the connecting-rod nearer the beam centre, it is unnecessary to show how beneficial it would be, in short-stroke engines, to joint it to the beam at a point farther from the centre. Besides, it is fully shown in the description of Mr. Whitelaw's engine in your July part.

Your Derby correspondent imagines that Mr. Whitelaw's arrangement must involve ruinous friction on the piston-rod guides. Since the length of that end of the beam to which the piston-rod is connected, is, as compared with the stroke, of the proportion usually adopted—and as the lengthening of the other end of the beam can have no effect on the piston-rod guides, I am quite at a loss to discover whence this friction is to spring. Perhaps I don't understand the "principles of mechanics" as well as your Derby correspondent, in which case I shall be glad to learn from him on what grounds he makes the sweeping assertion respecting the point in question.

With regard to Mr. Whitelaw's admirable governors, your correspondent seems to be unaware how ill adapted, for actuating some of the best kinds of expansion-valves, Mr. Field's cam has shown itself in practice. His ideas, too, respecting friction, are again at fault when he says, "plus the friction required to twist it round the spiral." I doubt if any practical man would think such a trifle worth estimating. Calling the thing "unmechanical" is meaningless, or tantamount to saying it does not "look well;" and as to being "difficult to fit," I would engage to construct a tool in a day or two that would turn off, at short notice, as many perfectly fitting grooves and feathers as would supply all the steam-engines in existence.

Not to take up too much of your valuable space, I will conclude by describing a simple arrangement that might be adopted, to obviate the objections raised against Mr. Whitelaw's equilibrium slide valve.



In the accompanying drawing, A is a small cylinder; B, its piston; C, a pipe communicating with any part of the steam-pipe, or chest, between the throttle or cut-off valve and the slide; D is a pipe leading to the atmo-

sphere or the condenser, according as the engine is of the high pressure or condensing kind; E is a small pump, and F its plunger. The induction valve of the pump is at G; the eduction valve at H; I is the induction pipe; and J, a pipe leading to the grooves or recesses in the cylinder and valve faces. To the end of the piston-rod at K, is to be jointed a lever, worked similarly to the one, B C, in fig. 19 of the descriptive engraving in your July number.

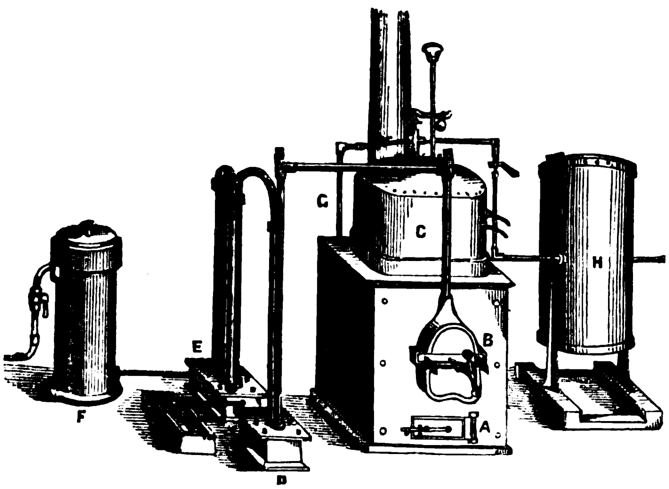
The action of this apparatus needs no explanation; and it only remains for me to show what the diameter of the cylinder, A, should be. I will assume the size of valve, &c., adopted in your correspondent's calculations, namely, 12 inches square, 8 inches being the area of the grooves. Supposing the valve is to be relieved of two-thirds of the pressure, we shall have $\frac{12 \times 12}{8} \times \frac{2}{3} = 12$, and $12^{\frac{1}{2}} = 3{\cdot}46$—say $3\frac{1}{2}$ inches = the diameter of the piston, B, that of the plunger, F, being 1 inch. Surely this is no formidable affair. If the plunger, F, were ½ or ¾, instead of 1 inch in diameter, it would still be large enough, and the size of the apparatus would then be very small. I think that some arrangement of this kind would do away with your correspondent's "nice, little, condensing apparatus," his "havoc with pistons and cylinder ends," his "provision after a sort," "waste of fuel" and "enormous pressure," &c.; and, before denominating as "would-be improvements" any of such merit as Mr. Whitelaw's, he would do well to re-examine the matter more carefully, after having studied rather more than the "first general principles of mechanics."

JOHN DODS.

Glasgow, August, 1852.

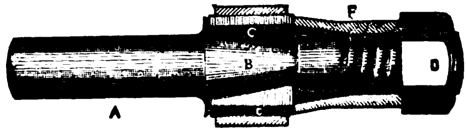
MONTHLY NOTES.

COMBINED GAS APPARATUS AND STEAM GENERATOR.—At the Royal Agricultural Show, held at Lewes, in July, Mr. Stanley, of Peterboro', exhibited a novel apparatus, combining an arrangement for producing coal gas, and generating steam to cook food for cattle, and other purposes, or to actuate a small engine. Our engraving represents the apparatus in perspective, with the gas-holder removed.



The same fire which heats the retort, also generates the steam—the furnace being at A, and the retort, B, immediately over it, whilst the boiler, C, is at the top. The gas, as generated in the retort, passes off to the hydraulic main, D, thence to the condenser, E, and finally to the purifier, F. In addition to this simple way of obtaining gas from coal, a steam-pipe, G, brings steam from the boiler to the back end of the retort. The steam being passed over pieces of red-hot iron, is decomposed, the oxygen being taken up, whilst the hydrogen is liberated and becomes mixed with the carbonaceous vapour, and is thus rendered illuminating. Besides this, the retort is, or may be, made with a division in it, and the condensible products of the coal being passed over its red-hot surface, are, to a great extent, converted into permanent elastic gas. With coal at 15s. per ton, Mr. Bower states that he can produce gas for 2s. 6d. per 1,000 feet. He gives the relative cost of other light-producing matters, as compared with gas, as follows:—Coal gas, 1,000 feet, 2s. 6d., gives the same light as 32s. worth of sperm oil, at 8s. a gallon; 18s. worth of solar oil, at 4s. a gallon; and 22s. worth of tallow candles, at 6d. per lb. Our figure also exhibits a steaming-pan, H, for farm-yard use.

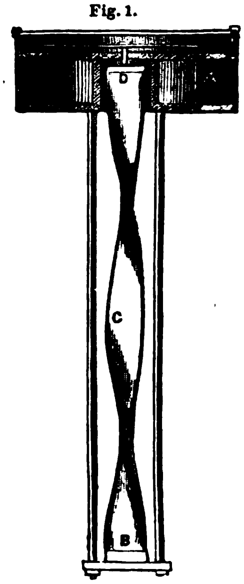
WORKSHOP ECONOMICS—HICK'S EXPANDING MANDRIL.—Some ten or twelve years ago, Mr. Hick, of Bolton, obtained the medal of the Society of Arts for an ingenious little instrument, which, we are persuaded, would be oftener found in our workshops, were it better known than it is. We refer to the "Expanding Mandril," which is adjustable, or variable in diameter, to answer for turning work of several different diameters. Our engraving represents the mandril in partial longitudinal section, as adjusted to turn a ring or open cylinder. The body of the mandril, A, is made conical at the part B, and this cone has in it four longitudinal dove-tailed grooves at



equal distances asunder, and fitted to receive the inner edges of four sliding wedges, C. The other end of the mandril has a square-threaded screw on it, for the adjusting nut, D, by which the turner can set up the wedges, C, to any part of their inclines; for as the nut, D, is turned forward, it screws up the hollow cylindro-conical collar, E, abutting against the ends of the wedges. The external sectioned ring represents the work in the lathe, firmly held by setting the wedges so far up their inclines, that they shall press hard against the interior of the bore of the work. This mandril has been in extensive use in Mr. Hick's works, as well as in those of many other Lancashire engineers, ever since its invention. By its adoption, the workman is relieved from the trouble and loss of time incidental to the search for, and fitting a new mandril for every change in the bore of his work, however trifling that change may be, as is the case with the common non-expanding mandril; whilst the employer similarly escapes the infliction of a heavy stock of the instruments, and the expense involved in their use.

BOURDON'S MANOMETER, OR PRESSURE GUAGE.—In addition to the employment of this curious principle for the mere measurement of direct pressure,—in the manner which we sometime ago explained,*—Mr. Bourdon has arranged it for use as a barometer, pyrometer, thermometer, and, more curious still, as a motive-power engine. The great extent of motion really obtainable in expanding tubes on this class, renders their application to some of these purposes much easier than it would seem to be in the eyes of all who have not actually tested it. For instance, a very flatly elliptical tube, three inches wide, and bent to a circle of ten inches diameter, will give a motion of the free end of three inches, by the simple blowing and sucking action of the mouth. If the curved flattened tube is filled with alcohol, and hermetically closed, it becomes a thermometer. The tube being of metal, transmits external changes of temperature to the enclosed liquid with greater rapidity than a glass thermometer; and very minute changes in the volume of the alcohol are made plainly manifest by the index. The pyrometer, for measuring very high temperatures, is made by connecting one of the pressure guages with a hollow ball of platinum filled with air, by means of a small tube. On exposure to heat, the air in the ball expands, and correspondingly effects the indicating tube. But a more peculiar arrangement is that where the flattened tube is twisted into a species of quick-threaded screw, or spiral, instead of bending to a regular curve. The indicating motion is, in this case, obtained from the effect of the internal pressure, in causing the twisted tube to untwist. The action of this twisted tube depends upon the law, that a surface curved in two directions cannot have its curvature increased in one direction, without a corresponding diminution of the curvature in the other. If any portion of the twisted tube is examined, it will be found to be curved in two directions; but instead of the two curvatures being at right angles to one another, they form an angle more or less acute, according to the nature of the twist. Fig. 1 of our engravings represents a simple thermometer on this principle, provided with a float, so as to suit it for brewers and others who have to test the temperature of large bodies of fluid. The float, A, is a hollow cylindrical case, to the bottom of which is attached a pair of parallel stay-rods, ending in a cross tail, B, answering as the fixed point for one end of the twisted tube, C. The other end of this tube is free, and has attached to it a centre, D, for an index hand, which works horizontally in a shallow case on the top of the float. This case having a glass face to it, allows of the temperature being read off on the dial in the bottom of the case, whilst the instrument is floating in the tested liquid. Another application, as well of the twisted as the coiled tube, is for the regulation of steam-boiler dampers, and with a thermometer its use may be extended to the regulating of an Arnott's stove or furnace. Fig. 2 exhibits the arrangement as adapted for a steam-engine indicator, by the substitution of a bent tube for the usual spring piston. Here A is a flattened tube, bent to a horse-shoe form, one end being a fixture at B, where the steam enters from the engine-cylinder. The opposite free end of the tube is jointed at C by a short link, midway in the length of a long lever, D, set on a fixed centre, E, and carrying a pencil at its upper extremity, F, for tracing the diagram, as dotted. The paper on which the diagram is to be traced, is fixed to the face of a flat vertical plate, G,

Fig. 1.



* Page 220, Vol. IV.

arranged to traverse back and forward on a vertical guide, H. This traverse is effected by the motion of the engine-beam, or parallel motion, by a cord passed over the pulley, J, the spindle of which carries a small toothed pinion, gearing with a a rack on the back of the plate. As the pulley can be quickly removed at any time, different sizes may be employed, thus affording great facilities for the application of the indicator to different engines, where the moving details may vary excessively in their range. The pulley spindle passes through a fixed hollow pin, to which is attached a spiral spring, enclosed in a flat circular box, so that the actuating cord is always kept in a proper state of tension. The ends of the diagrams are slightly curved, hence it is necessary to measure the figure with a curved scale of the same radius as the pencil lever. Our last illustration (fig. 3) is that of a single-acting steam-engine, constructed according to this principle of expansion and contraction. In this case, the actuating tube, A, is made of a pair of steel plates. The end, B, is fixed, and opens into the single steamport of a slide-valve. The other end of the tube is hinged at D, to the top of a vibrating pillar, E, as a support, whilst it is also jointed to a connecting-rod, F, just as in a common steam-engine—the crank being slotted to admit of the adjustment of its throw, to the actual amount of motion of the tube. As the labouring force of the tube is confined to one direction—that of its tendency to straighten—such engines are obviously only single-acting. They may, however, be worked with extreme rapidity. To avoid unnecessary loss of steam, the tube is filled with oil, so that the working steam employed at each stroke, is really only the amount for which the expansion of the tube, consequent upon the pressure, makes room. When the engine is non-condensing, the crank is set a little past the centre when the tube is inert; but in a condensing engine, it is set near half-stroke when at rest, as the tube expands

Fig. 2.

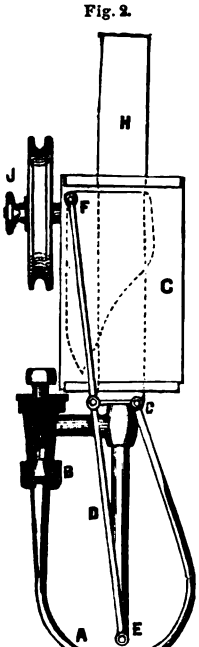
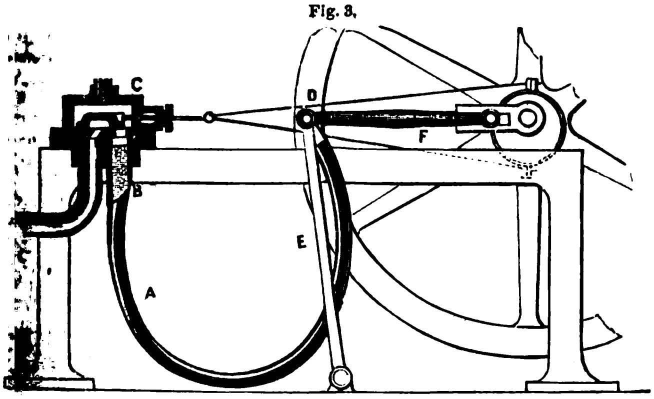


Fig. 3.



with the steam pressure, and collapses with the vacuum, so that, under the latter circumstance, it becomes a double-action machine.

KAEMMERER'S SAFETY AXLE.—Mr. Ernst Kaemmerer, of Bromberg, the inventor of the improved sowing machine, noticed by us at page 35, *ante*, is also the inventor of a very simple contrivance for securing wheels of all kinds on their axles. Fig. 1 is a longitudinal elevation of the arrangement, with the cover washer in section. Fig. 2 is a side view of the safety pin and ring detached; and fig. 3 is an edge view of the pin at right angles to fig. 2. The wheel is supposed to run on the part A of the axle, being retained by the washer, B. This again is held in position by the long solid-ended collar, C, entered upon the axle end. A flat pin, D, is passed transversely through a slot in the collar and axle, to hold up the former, and it is the ingenious mode of preventing the loss of this pin which constitutes Mr. Kaemmerer's contrivance. The pin, D, is slotted longitudinally through its centre, the upper end of the slot terminating in a round hole, large enough to admit of the entry of a metal ring, E; but the rest of the slot is only wide enough to receive a thin flattened portion of the ring, as shown

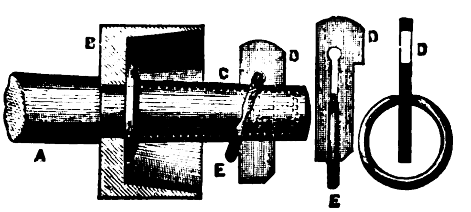


Fig. 1. Fig. 2. Fig. 3.

in fig 2. Fig. 3 illustrates the mode of adjusting this pin and ring, the ring being turned round until its flattened part can pass down the narrow slot of the pin, after the latter has been entered into the axle slot. This, then, allows the pin to be drawn far enough ont again, to let the ring pass beneath its lower end to its opposite side, as in fig. 1. The ring is then turned round, to bring its flattened part away from the slot, as in fig. 1. In this condition the wheel cannot leave the axle without the converse performance of all these movements, which, it is pretty clear, can never happen by any accident.

IRON SCREW COLLIERS FOR THE NEWCASTLE AND LONDON TRADE.—The first performance of the "John Bowes," the pioneer of a line of iron screw colliers from the Tyne to the Thames, has been most favourable. She left the Tyne on Tuesday the 29th of July, the first day that her engines had moved, and went under steam to Sunderland. She began to load at the New Dock with Hetton Wallsend coals, at twelve on Wednesday, and sailed at midnight with five hundred and forty tons. She reached the Collier Dock, Blackwall, at twelve on Friday night, and was discharged in the exceedingly short space of eighteen hours, by the use of Armstrong's hydrostatic cranes. On the return passage, the vessel sailed on the Sunday morning at twelve o'clock, arriving in the Tyne about eight on Tuesday morning, thus completing the double voyage within six days. Coals, which left the pit's mouth by her on the day of her loading, were delivered at the London consumer's house within four days. Her engines, just out of the engineer's shop, of course worked stiffly, and only got up to half speed, but it is expected that she will perform the passage in forty hours. She consumed not quite eight tons of coals on the passage.

COLLODIONIZED GLASS PHOTOGRAPHS.—We are gratified to learn that the photographic process of our valuable correspondent, "H. R."—described in his letter at page 210, Vol. IV., and the results of which we reported on so favourably at the time—has attracted the attention of American photographers. At the April meeting of the Franklin Institute, Dr. Rand, the Chairman of the Committee on Meetings, exhibited several photographs taken on this principle by Dr. R. C. Cresson, and our own good opinion of the new plan was satisfactorily echoed by the meeting, which decided that the specimens "fully attested the value of the process." Dr. Rand remarked, that from the improvements suggested by the daily experience of the gentlemen engaged in these experiments, he had no doubt he should be able to bring forward, at the next meeting, specimens showing a still further advance. And in this he kept his word, for at the May meeting he submitted some "Hyalotypes," taken by Dr. Cresson, according to "H. R.'s process," and showing marked superiority. The sensibility of the collodion film was said to be materially increased by the addition of bromine. The exhibited pictures were taken in from six to thirty-two seconds in diffused light, and in quarter and half-seconds in the open air.

ENGLISH PATENTS.

Sealed from 16th July, to 12th August, 1852.

John Hunt, Rennes, France, gentleman,—"Certain machinery for washing and separating ores."—16th July.

William Fawcett, Kidderminster, Worcester,—"Certain improvements in the manufacture of carpets." This patent being opposed at the Great Seal, was not sealed till 17th July, but bears date the 2nd February last, by order of the Lord Chancellor.

Joseph William Schlesinger, Brixton, Surrey, gentleman,—"Improvements in fire-arms, in cartridges, and in the manufacture of powder."—(Being partly a communication.)—20th.

Julius Friedrich Phillipp Ludwig Von Sparre, Brewer-street, Golden-square, mining engineer,—"Improvements in separating substances of different specific gravities, and in the machinery and apparatus employed therein."—20th.

Stribblehill Norwood May, Fitzroy-square, gentleman,—"Certain improvements in the manufacture of thread, yarn, and various textile fabrics, from certain fibrous matters."—20th.

Emery Rider, Bradford, Wilts, manufacturer,—"Improvements in the manufacture or treatment of India-rubber and gutta percha, and in the application thereof."—20th.

John Shaw, Dukinfield, Chester, cylinder-maker,—"Certain improvements in machinery or apparatus for carding cotton, wool, flax, and other fibrous materials."—20th.

Sir William Burnett, Knight Companion of the most Honourable Order of the Bath, Somerset-house, Middlesex, an extension for the term of seven years from the 26th day of July, 1852, being the expiration of the original grant of his patent for "improvements in preserving wood and other vegetable matters from decay."—20th.

John Francis Egan, Covent-garden,—"Improvements in the manufacture of sugar."—(A communication.)—20th.

James M'Henry, Liverpool, merchant,—"Certain improvements in machinery for manufacturing bricks and tiles."—(A communication.)—20th.

Richard Bealey, Radcliffe, Lancaster, bleacher,—"Certain improvements in apparatus used in bleaching,"—20th.

George Augustus Huddart, Brynkir, Carnarvon, Esq.,—"Improvements in the manufacture of cigars."—20th.

Richard Birckton and Thomas Lawson, both of Leeds, York, manufacturers,—"Certain improvements in the adaptation and application of a new manufactured material to certain articles of dress."—21st.

John Kirkham, New-road, Middlesex, civil engineer, and Thomas Nesham Kirkham, Fulham, civil engineer,—"Improvements in the manufacture of gas for lighting and heating."—22d.

Henry Bessemer, Baxter House, Old St. Pancras-road,—"Improvements in the manufacture, refining, and treating sugar, part of which improvements are applicable for evaporating other fluids."—24th.

Henry Houldsworth and James Houldsworth, both of Manchester, silk manufacturers,—"Certain improvements in the fixing, extending, and holding of cloth to receive embroidery, and in apparatus applicable thereto."—27th.

James Denton, Oldham, Lancaster, spindle and fly-maker,—"Certain improvements in machinery or apparatus for preparing cotton and other fibrous materials."—29th.

Frederick Winter, Eldon-street, Finsbury, roche manufacturer,—"Certain improvements in the construction of machinery for supplying rotatory motion to carriages, vessels, and water-mills."—29th.

John Martin, Barmer, Norfolk, farmer,—"Improvements in implements for hoeing."—29th.

Auguste Edouard Laradoux Bellford, Castle-street, Holborn,—"Certain improvements in the manufacture of sheet-iron."—(A communication.)—29th.

Pierre Armand Lecomte de Fontainemoreau, South-street, Finsbury,—"Certain im-

provements in the construction of taps and cocks for fluids and liquids."—(A communication.)—29th.

Henry Wickens, Carlton Chambers, Regent-street, Westminster, gentleman,—"Improvements in obtaining motive power."—(A communication.)—31st.

Samuel Starkey, Clapton, Middlesex, gentleman,—"Improvements in machinery for washing minerals, and separating them from other substances."—31st.

John Gerald Potter, Over Darwen, Lancaster, carpet manufacturer, and Matthew Smith, of the same place, manager,—"Certain improvements in the manufacture of carpets, rugs, and other similar fabrics."—31st.

William Edward Newton, Chancery-lane, Middlesex, civil engineer,—"Improvements in the construction of wheels for carriages."—(A communication.)—31st.

William Ackroyd, Birkenshaw, near Leeds,—"Improvements in the manufacture of yarn and fabrics, when cotton, wool, and silk are employed."—31st.

William Hetherington, Hansworth, near Birmingham, gentleman,—"Improved machinery for stamping or shaping metals."—(A communication.)—3d August.

Alfred Vincent Newton, Chancery-lane,—"Improvements in the manufacture of metallic fences, which improvements are also applicable to the manufacture of verandas, to truss frames for bridges, and to other analogous manufactures."—(A communication.)—7th.

Roger Hind, Warrington, engineer,—"Certain improvements in the construction of machinery or apparatus applicable to weighing machines, weigh bridges, railway turntables, cranes, and other similar apparatus."—7th.

Alexander Mills Dix, Salford, Lancaster, brewer,—"Certain improvements in artificial illumination, and in the apparatus connected therewith, which improvements are also applicable to heating and other similar purposes."—7th.

Richard Archibald Brooman, of the firm of J. C. Robertson & Co., of Fleet-street, patent agent,—"Improvements in the manufacture of manure."—(A communication.)—10th.

Edward Joseph Hughes, Manchester,—"Improvements in machinery or apparatus for spinning and weaving cotton, wool, and other fibrous substances, and also in machinery or apparatus for stitching either plain or ornamentally."—10th.

Robert Weare, Plumstead-common, Kent, electrical engineer,—"Improvements in galvanic batteries."—12th.

Melchior Colson, Finsbury-square, Middlesex, civil engineer,—"Certain improvements in the construction of vehicles."—12th.

Daniel Adamson and Leonard Cooper, Newton-wood Iron-works, near Hyde, Cheshire,—"Certain improvements in the construction of steam-engines and steam-boilers, also in the method of using and rarefying steam, part of which improvements are applicable to marine locomotive and other boilers, and marine architecture in general, as well as in cisterns, tanks, and articles of a like nature."—12th.

Richard Laming, Millwall, Middlesex, chemist,—"Improvements in the manufacture and the burning of gas, in the treatment of residual products of such manufactures, and of the distillation of coal, or similar substances, and of the cokeing of coal."—12th.

Nathaniel Jones Amies, Manchester, manufacturer,—"Certain improvements in the manufacture of braid, and in the machinery or apparatus connected therewith."—12th.

Francois Bernard Bekaert, Cecil-street, Strand,—"Improvements in the manufacture of zinc white."—(A communication.)—12th.

James Lowe, Charlotte-place, Upper Grange-road, Bermondsey, mechanic, and Thomas Eyre Wych, George-street, Mansion-house, London, gentleman,—"Improvements in propelling vessels."—19th.

William Palmer, Sutton-street, Clerkenwell, Middlesex, manufacturer,—"Improvements in the manufacture of candles and candle-lamps, and in packing candles and night-lights."—19th.

Thomas Hunt, Leman-street, Goodman's-fields, Middlesex, gunmaker,—"Improvements in fire-arms."—19th.

Henry Rawson, Leicester,—"Improvements in preparing and straightening wool and other fibrous materials."—19th.

Henry Spencer, Rochdale, Lancaster, manager, —"Certain improvements in machinery or apparatus for preparing, spinning, and weaving cotton and other fibrous substances."—19th.

Charles Butler Clough, Tyddyn Mold, Flint, gentleman, I. P.—Certain improvements in machinery or apparatus applicable to the purposes of brushing and cleaning."—19th.

Pierre Armand Lecomte de Fontainemoreau, South-street, Finsbury, Middlesex, patent agent,—"Certain improvements in cutting schistus for slates."—(Being a communication.)—19th.

Samuel Nichols, Coldham-street, Nottingham, mechanic, John Livesey, New Lenton, in the same county, draughtsman, and Edward Wroughton, New Lenton, in the county aforesaid, mechanic,—"Improvements in the manufacture of textile fabrics, and in machinery for producing such fabrics."—19th.

SCOTCH PATENTS.

Sealed from 22d June, to 22d July, 1852.

John Davie Morries Stirling, of Black Grange, N.B., Esq.,—"Certain alloys and combinations of metals."—June 22d.

Alfred Vincent Newton, Office for Patents, 66 Chancery-lane, Middlesex, mechanical draughtsman,—"Improvements in separating substances of different specific gravities."—23d.

John Henry Johnson, 47 Lincoln's-Inn-Fields, Middlesex, and Glasgow, North Britain, gentleman,—"Improvements in steam-engines."—(Communication.)—28th.

John Linton Arabin Simmons, 67 Oxford-terrace, Hyde-park, Middlesex, Captain in the Royal Engineers, and Thomas Walker, Brunswick Iron Works, Wednesbury, Stafford, Esq.,—"Improvements in the manufacture of ordnance, and in the construction and manufacture of carriages and traversing apparatus for manufacturing the same."—28th.

Frederick Sang, 58 Pall-mall, Middlesex, artist in fresco,—"Improvements in machinery or apparatus for cutting, sawing, grinding, and polishing."—30th.

Peter Bruff, Ipswich, Suffolk, civil engineer,—"Improvements in the construction of the permanent way of rail, tram, or other roads, and in the rolling stock or apparatus used therefor."—July 5th.

George Laycock, Albany, United States, America, dyer, but now of Doncaster, York, tanner,—"Improvements in tanning and unhairing skins."—6th.

Robert John Smith, Islington, Middlesex,—"Certain improvements in machinery or apparatus for steering ships or other vessels."—7th.

James Higgin, Manchester, Lancaster, manufacturing chemist,—"Certain improvements in bleaching and scouring woven and textile fabrics and yarns."—8th.

William Beckett Johnson, Manchester, Lancaster, manager for Messrs. Ormerod and Son, engineers and ironfounders,—"Improvements in railways, and in apparatus for generating steam."—12th.

Richard Parris, Long-acre, Middlesex, modeller,—"Improvements in machinery or apparatus for cutting and shaping cork."—12th.

Peter Armand Le Comte de Fontainemoreau, 4 South-street, Finsbury, London, Middlesex, patent agent,—"Improvements in the apparatus for kneading and baking bread, and other articles of food of a similar nature."—13th.

Alfred Vincent Newton, Office for Patents, 66 Chancery-lane, Middlesex, mechanical draughtsman,—"Improvements in machinery for cutting soap into slabs, bars, or cakes."—15th.

Richard Laming, Millwall, Middlesex, chemist,—"Improvements in the manufacture and the burning of gas, in the treatment of residual products of such manufacture, and of the distillation of coal or similar substances, and of the coking of coal, and in the application of a certain substance which may be obtained from such treatment to the manufacture of paper."—13th.

William Reid, University-street, electric telegraph engineer, and Thomas Watkins Benjamin Brett, Hanover-square, gentleman,—"Improvements in electric telegraphs."—19th.

Emery Rider, Bradford, Wilts, manufacturer,—"Improvements in the manufacture or treatment of india-rubber and gutta percha, and in the applications thereof."—19th.

Charles Augustus Preller, Abchurch-lane, London, gentleman,—"Improvements in the preparation and preservation of skins and animal and vegetable substances."—19th.

Peter Armand Le Comte de Fontainemoreau, 4 South-street, Finsbury, London, Middlesex, patent agent,—"Certain improvements in railways and locomotive engines, which said improvements are also applicable to every kind of transmission of motion."—21st.

Joseph Maudslay, of the firm of Maudslay, Sons, & Field, Lambeth, Surrey, engineer,—"Improvements in steam-engines, which are also applicable wholly, or in part, to pumps and other motive machines."—21st.

William Septimus Losh, Wreay, Syke, Cumberland, gentleman,—"Improvements in obtaining salts of soda."—21st.

Richard Archibald Brooman, of the firm of J. C. Robertson & Co., 166 Fleet-street, London, Middlesex, patent agents,—"Improvements in the purification and decoloration of oils, and in the apparatus employed therein."—21st.

Robert Hesketh, Wimpole-street, Mary-le-bone, Middlesex,—"Improvements in apparatus for reflecting light into rooms, and other parts of buildings and places."—22d.

Edward Maitland Staples, Cheapside,—"Improvements in cutting mouldings, tongues, and other forms, and planing wood."—22d.

IRISH PATENTS.

Sealed from 21st June, to 16th July, 1852.

Richard Christopher, Mansell Ashford, Kent,—"Improvements in the construction of railways, railway rolling stock, and in the machinery for the manufacturing the same."—June 21st.

John Harcourt Brown, Aberdeen, Scotland, and John Mackintosh of the same place,—"Improvements in the manufacture of paper, and articles of paper."—21st.

Thomas Twells, Nottingham, manufacturer,—"Certain improvements in the manufacture of looped fabrics."—30th.

Peter Bruff, Ipswich, Suffolk, civil engineer,—"Improvements in the construction of the permanent way of rail, tram, or other roads, and in the rolling stock or other apparatus used thereof."—July 16th.

DESIGNS FOR ARTICLES OF UTILITY.

Registered from 15th July, to 7th August, 1852.

July 15th,	3333	W. Harkes, Lostock, Cheshire,—"Apparatus for cutting corn and other standing crops."
17th,	3334	M. Macpherson, St. Petersburgh,—"Annular boiler."
—	3335	G. H. & D. Nicholl, Dundee,—"Kitchen range."
—	3336	T. A. Readwin, Winchester-buildings,—"Revolving holder for pen, pencil, or toothpick."
20th,	3337	H. Barber, Leicester,—"Thread-carrier stop of a stocking-frame."
—	3338	Moran and Quin, Myddleton-street, Clerkenwell,—"Folded spring catch."
—	3339	W. Bown, Leicester,—"Apparatus for pluffing, fluting, and preserving the shape of gloves."
22d,	3340	W. Wigfall & Co., Sheffield.—"Saucepan cleaner."
23d,	3341	T. A. Readwin, Winchester-buildings,—"Revolving cutter and scythe-reaping machine."
28th,	3342	G. Whatton and D. Reading, Chambers-street,—"Roller-box for ships' blocks and various kinds of axles," &c.
30th,	3343	John Crosby, Fakenham,—"Safety sea-bathing machine."
—	3344	Richards & Co., Bishopsgate-street,—"Gold-washing machine."
—	3345	H. E. Thompson, Oxford-street,—"Portable metallic bedstead."
Aug. 2d,	3346	G. B. Davies, Halifax,—"Coat."
3d,	3347	W. Dray & Co., London-bridge,—"Box gearing."
6th,	3348	J. Lee, Birmingham,—"Combination gold-digging tool."
12th,	3349	P. Rigby, Liverpool,—"Washing apparatus for separating metals from sand," &c.
—	3350	H. Bennett, Liverpool,—"Double diamond tooth for bone mills."
17th,	3351	S. R. English, Birmingham,—"Embossing press."
19th,	3352	E. Goddard, Ipswich,—"Gas stove."

DESIGNS FOR ARTICLES OF UTILITY.

Provisionally Registered from 15th July, to 7th August, 1852.

July 15th,	443	J. Sutton, Newington, Surrey,—"Adjustable garden-pot and flower support."
—	444	T. E. Moore, Poland-street, Oxford-street,—"Machine for lasting upper-leathers."
—	445	T. Jones, Greenfield-street,—"Reversible-fronted shirt."
16th,	446	T. Bently & Sons, Liverpool,—"Centrefire pistol."
19th,	447	J. Bevan, Deptford,—"Round corner."
—	448	W. Wray & Son, Leeming, near Bedale,—"Reaping machine."
28th,	449	Capt. A. Collingridge, Brompton,—"Cygnet hook."
—	450	J. Browne, Upper Norton-street,—"Ventilating wreath, or pillar band, for hats and caps."
Aug. 7th,	451	A. E. L. Bellford, Castle-street, Holborn,—"Night lamp."
—	452	M. A. Baudit, Castle-street, Holborn,—"Inkstand."
13th,	453	H. Chatwin, Birmingham,—"Metallic covers for tablets."
14th,	454	W. Beales, Arlington-street, Camden-town,—"Pocket writing-case."
—	455	I. Rose, Goodge-street,—"Cooking apparatus."
17th,	456	C. Killinger, Dublin,—"Driving-seats for jaunting-cars and carriages."
19th,	457	M. Billing, High Holborn,—"Noiseless cornice pole and ring."

TO READERS AND CORRESPONDENTS.

"THE MECHANIC."—We have received this, and have returned the compliment.

STEAM VENTILATING FAN.—This will appear in our next number.

RECEIVED—"Remarks on the Combination of Timber and Iron Framings in the Building of Ships." By L. Arman & Co.—"A New General Theory of the Teeth of Wheels." By Edward Sang.—"A Letter to the Congestive Baukerhood of Great Britain."

CHEMICUS, Mostyn.—Mr. Masters' patent, dated November 17, 1846, for "Improvements in apparatus and means for cooling liquids and matters, and filtering and preventing liquids freezing," does not cover any chemical combinations, but consists of several different forms of refrigerators, in which broken ice, or the previously known freezing mixtures, are to be used.

GOLD AND ITS RESULTS.

It is now some months since, in these pages, the question was discussed, of disputes between employers and workmen, on account of the latter being in surplus, owing to insufficient work existing for all. The writer at that time expressed his conviction, that the only true remedy to be found was in emigration, and that the best mode of providing for that emigration was to expend directly the benefit funds in permanent relief, instead of distributing them at intervals over a long period of time, without effecting permanent relief.

The discovery of Australian gold has accomplished what all the counsel in the world could not have brought about. It is a means for equalizing population to the means of support. Henceforth, man, as a working being, will be at a premium. Two masters will be looking after one man, instead of two men looking after one master. Domestic service will be, as in the United States, difficult to obtain. The race of Dickens' "Marchionesses" will disappear, and mechanical science will be earnestly at work, so to construct and furnish human dwellings with all the labour-saving appliances of the workshop and factory, that drudgery will be at an end. The means exist even now, but the incentive to use those means is wanting to the unthinking, while men and women-servants are found to compete, as was the case with Irish labourers, for the privilege to waste human labour in useless and unnecessary drudgery.

Marvellous are the ways in which Providence works. Gold, of little intrinsic use, possesses a fancy value proportioned to the wildness of society, and the want of faith of man in man. It thus becomes the means of attaining sudden wealth, and those who are attracted to California and Australia, and other districts, in order to acquire it, become settlers to people the wilderness. As the quantity of gold increases, it will doubtless spread largely amongst semi-civilized nations, and its value may thus for some time be kept up, but infallibly the time will come when it will cease to be of value, save for the arts, by reason of its great abundance. The writer had lived long in gold-producing countries, long ere the Americans obtained possession of California, and more than once predicted, in print, what the result would be when the Anglo-Saxon replaced the Iberian race.

In many gold-producing countries, both proprietors and labourers at the mines reap very small gains. In some cases the gold-seeking is merely a contingency on other operations. Prior to the revolution which drove the Spanish rulers out of Chilé, a gentleman owned a level valley of some extent, situated south of Coquimbo. In that latitude, dry land, however good in quality, is useless for agricultural purposes, and the valley in question possessed no water. Nothing daunted, the owner set to work to turn the course of a stream some twenty miles distant, carrying the level along the winding sides of hills, till the water flowed over his valley in a full tide of irrigation. Labourers came, and the land was ploughed and planted. The crops were abundant, but a new difficulty arose, which the proprietor had not foreseen. The markets were so distant that the whole value of the crops was consumed in transit. It became clear that the produce must be consumed on the spot, and the only question was, whether the owner would give his land gratis, or whether he could find some mode of extracting a rent that might be transportable.

After some deliberation, he obtained the proprietorship of an abandoned gold mine, in which the workings had long been choked by water. Employing a number of labourers, he opened an adit in the hill-side, and succeeded in draining it. The mine consisted of quartz veins, and he erected an establishment for crushing it, in what is called a *trapichi* mill, with a vertical running stone, turned by the water power of his irrigation stream. Thus the labourers who worked the mine became the consumers of the valley produce, paying for it with their wages, which just equalled the value of the gold they extracted. Thus the affair went on for three years, when the water again gained on the workings, and stopped the operations. In this emergency, the owner, Don José, did not lose his courage. At the head of his adit, within the mine, he built up a tank, communicating with the adit. At the bottom of the working he dug another tank in the solid rock. He then set on some men, naked, save a girdle and a goatskin bag at the back of each. These men went one after the other to the bottom tank, and plunging in it, filled their goatskin, and ascended to discharge it into the upper tank. As the workings descended, another tank was dug, and more men put on. Thus a living pump was constructed, self-acting, each individual man serving for a bucket. And thus the labour went on; the only advantage of the mine being, that it enabled the labourers to pay the owner a rent for his land, and outlay of capital in the irrigation canal.

Thus, in California and Australia, the gold-digging will probably ultimately produce water tanks and railways, and many other public works, enabling colonists to increase and multiply, and relieve other lands from the pressure of population. If the supply of gold gets scarce, that is, if the labour of procuring it becomes too heavy, gold-working will lessen; but if the world at large continues to absorb it, it will go on, and probably produce results we have not yet dreamt of. Till within these few years, the gold-seekers of America have been Spaniards only, with little capital and no machinery. It was known long years back that there was gold in California, but it was not sought for. People would lead an easy life without it. But Anglo-Saxons, ever on the watch to "make a fortune," discovered it and worked it. The stimulus spread to Australia, and there also gold was discovered, first on the mainland, and then on Van Dieman's Land. Now it is found in Demerara, and ultimately it will probably be found throughout the whole continent of America, as well as in other continents where circumstances may be favourable for working it.

In truth, there is probably as much of gold as of other metals existing in the world, only it is more difficult to be got at. Gold is only known to exist in the metallic state. It is found in many forms—masses, lumps, fragments, dust, and infinitesimally mixed with the auriferous quartz; but always mechanically mixed, and never chemically, as is the case with other metallic ores. The process of discovering gold mines is a very simple one. The writer once made a week's trip with a South American *cateador*, or gold mine-hunter, for the purpose of knowledge. His clothes were made of coarse blue baize, save in exposed parts, which were covered with a sheathing of untanned hide. He wore a hinder apron of this material, and sandals of the same. Tied round his waist was his *poncho*, to serve him as a cloak by day, and a bed by night. At his back was slung a keg of water, about the size of a smuggler's brandy keg. At one side hung a hide sack, containing some parched barley-meal, and a similar bag on the other, containing two peculiar spoons, formed of a bullock's horn, cut longitudinally, and a small hard stone, resembling a painter's hand-grinding stone. Leaving our mules on the borders of the extreme vegetable altitude, we entered a narrow ravine between lofty ridges of hills, our friend looking continually at the stones before his feet, which became more and more abundant, till nothing was seen but clay-slate shingle. At the end of the ravine night fell, and after mixing some parched meal with a little water by way of supper, we smoothed down some shingle, and, wrapped in ponchos, took such sleep as we might till daybreak. On the second day we turned up another ravine, and about mid-day our friend picked up a stone, which he examined with some attention, and then went on. About mid-day we stopped, and he picked up a fragment of quartz from amidst a great variety of stones. He then placed it on a flat piece of rock, and pounded it and ground it to powder, which he placed in the horn, and poured some water on it, shaking it about with a peculiar motion. A second and a third water were added, and finally he showed a fringe of fine gold on the black horn, along the edge of the quartz sand. No vestige of gold could be discovered in the quartz before grinding. Satisfied with the

result, he went on tracking the fragments of quartz till at last we came to the vein, in granite rock. He selected a few pieces, which he put in his wallet, then piled up some stones to mark the spot, and we set out on our return home. In a neighbouring valley he exhibited his stones to a proprietor, whose business it was to extract gold from quartz, and sold him his new discovery for the sum of twenty-five dollars.

The mode of extracting the gold was very simple. A vertical running stone traversed in a circular stone trough. Quartz, broken to the size of walnuts, was thrown into this trough, with several pounds of mercury. A small stream of water trickled into the trough, and flowed over at a particular spot, carrying with it the finer ground particles. At the depth of a foot it fell into a goatskin bag, with some quicksilver in it, thence into a second, third, fourth, and fifth bag, as long as any fall could be obtained. After working several hours the mill was stopped, and all the mercury collected in a long narrow linen bag. In this it was rammed with a stick, and squeezed till only the amalgam of gold was left. This was placed on a piece of heated iron, on a brick standing in water. An earthen cupola was placed over it, forming a water joint at bottom, and the neck of the cupola descended into water. Thus the fumes of the sublimated mercury were collected, and the metal saved. The spongy gold, called "pine gold," was left on the iron.

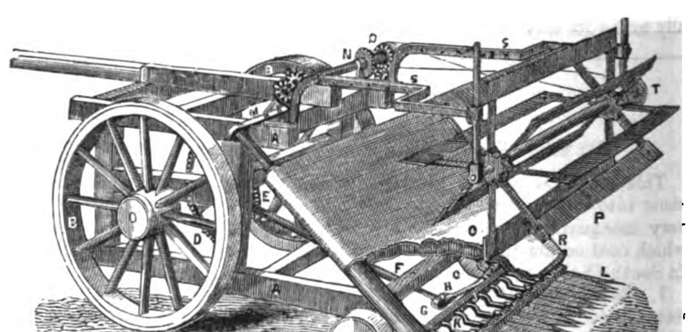
The probability that gold exists in great quantities in the world, may be thus reasoned on. Many metals are found in such chemical combinations, that they are considerably lighter than in their metallic state, or the rocks in which they are found. Quartz rock is the matrix of gold, and quartz rock is commonly a vein, of greater or less thickness, intersecting the beds of granite. In this quartz the metallic gold is distributed, in particles of more or less fineness, and sometimes it is found in lumps. If the granite be supposed to have been once in a state of fusion, and cracked in cooling, forcing up into the fissures the liquid quartz containing the gold, it seems more than probable that the greater part of the molten gold would settle to the bottom of the furnace, as the metal settles down in an iron furnace, beneath the slag. The fragments that are found in rivers and alluvial ground, have probably been thrown out by subsequent volcanic action. The "spangle gold," the "nuggets," the "gold dust," and other varieties, seem to confirm this; and probably in depths of alluvion greater than have been yet penetrated, large golden fragments will be discovered, just as the hugest fragments of rock are found lowest in the beds of mountain torrents. The history of most abandoned South American gold mines records, that the water came in and drowned them when they were at their richest. If this theory be correct, it is quite within possibility that the gold-hunters, who have as yet explored but a small portion of the earth's surface, may light upon larger deposits—may yet penetrate to some mass larger than the famed native iron of Santiago del Estero, or a quartz vein gradually changing into the pure metal. If these things come to pass, we shall doubtless find many uses for it, but not as coin. It will have played its part, like many of the extinct things of creation, and will be written down amongst the things that were, a matter for future generations to wonder at, like the Dutch tulip trade. It is a commercial instrument of man's barbarous condition. It may furnish the culinary utensils of some future time, when, even if it be worth stealing, the better teaching of mankind may have put away theft as a profitless trade. Meanwhile, the greater part of America, and the mountains of India and Africa, have yet to be ransacked by the gold-finders, and there are hills in Spain almost as little known as California was before the advent of the Anglo-Saxon. The Chinamen may carry home knowledge that will open the hills of their own land; and the beds of the "golden" Tagus and Ebro may yet be dug up, when industry shall have diverted their much-needed waters to the purpose of irrigation, the true wealth-producing process of the South. The lighter fragments, washed to the edges by the stream, have alone been gathered. They were but indications of the larger masses that yet lie in deposit below. When Sutter first dug his mill-race in California, he gave the impulse, and so far may be said to be the discoverer. And it may be predicted, that wherever gold has been superficially gathered at any period, it will be found in larger masses at "a deeper depth still." The Spanish peninsula will acquire a large emigrant population, when some quiet reasoning speculator shall first open up there a gold deposit.

W. Bridges Adams.

THE SCOTTISH REAPING MACHINE.

The recent agricultural show at Perth will hereafter be noted as the means of effecting what a quarter of a century's experience had failed in accomplishing, for it has created a feeling of interest in a really important piece of agricultural mechanism—the Rev. Patrick Bell's reaper. It is strange enough that this machine, which has been so successful in the harvest fields of Forfarshire, should never have crossed the border, or, indeed, made itself known beyond the immediate scene of its origin; whilst the Exhibition of last year was sounding far and wide the praises of Hussey and M'Cormick, and assigning a Council medal to an American scheme evidently founded upon its British predecessor. The Bell machine is the invention of the Rev. Patrick Bell, minister of the parish of Carmylie, in Forfarshire, while much of its success on the farm is attributable to his brother, Mr. G. Bell of Inchmichael, Errol, in the Carse of Gowrie, who has worked it for the last fourteen years on his own farm.

Our engraving represents the machine in perspective. It consists of an open timber frame, A, of four feet square in plan, and three feet high: and runs on a pair of main wheels, B, four feet in diameter, and two small front wheels, C, eighteen inches in diameter, which latter support the front bar of the cutters. The large wheels, B, are connected by clutches with their axle, which revolves in bearings in the central horizontal timber bar on each side, and this axle carries a bevil wheel, D, twenty inches diameter, and driving a pinion, E, on the upper end of the inclined shaft, F. This shaft works in bearings in the interior of the frame, and has at its lower end a short crank, G, from the pin of which a short connecting-rod, H, passes to the cutter tail-bar, J, having jointed to it the tails, K, of the moveable blades of the series of shears, L. The same bevil wheel, D, also drives a pinion on the lower end of the short inclined shaft, M, the upper end of which actuates a cross shaft, N, by means of a pair of bevil pinions. It is this shaft which gives motion both to the endless web, or carrying cloth, O, and the revolving collecting vanes, P. The web is driven by an arrangement of three bevil pinions, Q, fitted with a clutch, so that the web roller, R, on the spindle of which the central bevil pinion is fixed,



may be driven in reverse directions, at pleasure. A corresponding roller on the opposite side serves to stretch the web across the machine at an inclination of about 45°. The iron bars, S, bolted at one end to the framing, have each an adjustable vertical bar at the other carrying-end bearings, for the spindle of the vanes, P, which collect and carry the cut corn to the endless web. This spindle is actuated by a crossed band from a small pulley on the end of the shaft, N, passing to a pulley, T, on the end of the vane spindle; and the vane is easily adjustable vertically, to suit any height of grain, as well as horizontally, for the proper delivery of the cut grain to the web. The cutter consists of a fixed iron bar, U, six feet in length, so as to project beyond all the details of the machine. It is secured to the front part of the frame by a pair of iron brackets,

and the thirteen fixed blades, V, of the shears are bolted to it at regular intervals asunder. The same bar also carries the twelve moveable blades, each oscillating on a stud-centre, and prolonged backwards in a tail-piece, K, the extremity of which rests loosely between a pair of pegs correspondingly set in the vibrating bar, J. The machine is worked by a pair of horses, yoked by ordinary draught-bars to the pole, W, so that the cutters go right into the corn before the rest of the apparatus. The quick turning at the end of a ridge is effected by disengaging one of the main wheels from the cutter apparatus. Each turn of these main wheels carries the machine over about twelve feet of ground, and the beviled wheel and pinion, D, E, being in the proportions of six to one, the cutter tail-bar makes six vibrations in this length of traverse, but as the moveable blades are ancipital, they each make twelve cuts in this space. The cuts extend to twelve inches forward, and as the cutting blades are twelve inches long, the uncut corn can never reach the roots of the blades, so as to choke or impede their action. As the corn is being severed, the revolving vanes catch hold of it as it stands, retaining it up against the cutting pressure; their essential office, however, being, to lay the cut corn down on the web behind. From the web it is carried directly to either side, where it falls to the ground in sufficient regularity for being bound at once into sheaves.

In the internal mechanism of the machine now being exhibited by Mr. G. Bell, the movements are a good deal simplified. The second motion-shaft, N, is driven by a pitch chain from the main axle, which also carries a wheel or pulley, with a zig-zag scroll projection on its periphery, for actuating a vibrating lever working the cutters. This lever takes the place of the inclined shaft, F, and it is set upon a fixed centre, so that as one end is made to vibrate by the zig-zag scroll, the other passes directly to the cutters, to traverse them as required. The bevil gear and other details are thus dispensed with.

In Mr. Bell's practice, one man drives and conducts the machine, whilst eight women collect the cut corn into sheaves, and prepare bands for them, and four men close and bind the sheaves, leaving work for two more men in setting up the sheaves into stooks. The work performed averages twelve imperial acres per day. The average expense of working the reaper, as deduced from a fourteen years' trial, is 3s. 6d. per acre, including food for the workers; being, in round numbers, an effective saving of one half the cost of hand-reaping.

The future career of the American machines is hard to be made out, for we one day read of splendid successes, whilst the record of the next is a blank and unmitigated failure. Practical opinions cannot be long divided upon a truly meritorious contrivance, but we have endless disagreements as to the economical value of all or most of the modern machines, whilst that of 1828 has always met with favour. The manufacture of the latter machine is unrestricted, and as there is now a growing disposition towards the adaptation of mechanism to all the operations of the farmer, it is more than probable that the Bell machine will gradually make its way over the country, and utterly supersede the sickle.

OUTLINES OF GEOLOGY.

IV.

PALÆOZOIC EPOCH CONCLUDED.—CARBONIFEROUS SYSTEM.

This system is, on several accounts, the most interesting of the divisions into which the strata of Great Britain have been divided. It is very unequally developed in different localities. The strata among which coal occurs (called the coal measures) are only one member of it. In South Wales, two members of the system occur, namely:—

1. *Coal measures.*—A mass, estimated to have a thickness of 12,000 feet, consisting of alternations of slates and sandstones, with interspersed beds of coal, some layers of ironstone, and (rarely) thin layers of limestone. The thickest bed of coal is 9 feet, and it is estimated that all the beds together give 100 feet (in thickness) of workable coal.

2. *Mountain limestone.*—Calcareous rocks, with occasional layers of red oxide of iron and chert nodules; the whole from 500 to 1500 feet in thickness.

In Derbyshire, and the north-western parts of Yorkshire, millstone grit and limestone shale occur between the coal measures and the mountain limestone. The former consists of a compact sandy conglomerate, interspersed with beds of sandstone shale, freestone, limestone, ironstones, and not unfrequently thin seams of coal; it is sometimes 1000 feet in thickness. The limestone shale (Yoredale rocks of Yorkshire) is made up of limestone shale, sandstone, and thin seams of coal, and the whole series of beds is there 1000 feet thick. The true mountain or scar limestone then follows; it is much more developed in the north than in the south of England.

In Devonshire, the carboniferous system is represented by the culmiferous beds, which, in their upper part, consist of sandstones, indurated shales, with culm, an imperfect coal, and, in their lower part, of limestones, sandstones, and carbonaceous and calcareous shales.

If a line be drawn from Sunderland, through Leicester, to the coal-field of Bristol, and thence round the eastern edge of the Mendip hills, (which are formed of mountain limestone,) to Exeter and Launceston, it would include, to the north of the line, all the members of the carboniferous system which occur in England. The same line, carried from Exeter due south to the sea, instead of westward to Launceston, would embrace all the rocks—igneous, metamorphic, and fossiliferous—which we have yet described in England.

Turning now to Ireland, we find a great development of one, but the least valuable part of the system—namely, the mountain limestone. The greatest part of the interior of Ireland consists of this rock, which, in some localities, is covered by coal measures. Excluding the metamorphic rocks, and that tract of strata newer than the carboniferous, which would be cut off by a line from Belfast to Lough Foyle, nearly all the remainder of Ireland belongs to the carboniferous system. In Scotland, the mountain limestone is very much less, and the coal measures much more, developed than in Ireland.

The mountain limestone is almost entirely composed of animal remains, principally shells and corals. Geologists consider it as the remains of vast coral reefs, which were formed in tranquil oceans.

The principal coal-fields of England are—

1. Northumberland and Durham district.
2. Cumberland, Westmorland, and West Riding of Yorkshire.
3. Lancashire, Flintshire, and North Staffordshire.
4. Yorkshire, Nottinghamshire, and Derbyshire.
5. Shropshire and Worcestershire.
6. South Staffordshire.
7. Warwickshire and Leicestershire.
8. Somersetshire and Gloucestershire.
9. South Welsh coal-fields.

The thickness of any one bed of coal never exceeds in England 40 feet, and is sometimes only of a few inches. The average thickness is about 6 feet.

There are seven coal-fields in Ireland, as follows:—Ulster, three; Leinster, one; Munster, two; Connaught, one.

The beds to the north of Dublin yield bituminous coal, those to the south only anthracite. At the northern extremity of Antrim, a small coal-field occurs under interesting circumstances; it rests on mica slate, without, therefore, either any of the other members of the carboniferous system intervening, or any of the older palæozoic strata.

In Scotland, the coal measures occupy a single large basin, the northern limit of which lies from the river Eden, in Fifeshire, along the southern part of the Ochill hills, to near Alloa. It then crosses the Forth, and proceeds south-west towards Glasgow. Crossing the Clyde, about eight miles west of Glasgow, it continues in a south-western direction to the coast at Irvine, in Ayrshire. On the south, the basin is bounded by the Lammermuir and Pentland hills; and after widening out in Lanarkshire, it contracts again, and terminates near Girvan, in the south of Ayrshire.

Sandstones occur in unusually large quantities among the beds associated with the coal measures in Scotland. The bed of limestone, however, which is supposed to belong to the lower coal measures, deserves especial mention. It occurs about four miles south-east of Edinburgh, and is called the Burdiehouse* limestone. This limestone is apparently of fresh-water origin, and contains an abundance of vegetable impressions, similar to those which occur among the coal measures. The remains of extinct fish also occur in abundance, and among them those of the remarkable megalichthys, a fish belonging to a group now called sauroids, from their resemblance to reptiles.

Attempts have been made to estimate the total quantity of coal existing in England. We give the estimates referring to five out of nine of our principal coal-fields.

	Estimated quantity of coal in millions of tons.
Northumberland and Durham district,..................	8,750
Lancashire, &c..	8,500
Shropshire, &c..	800
Warwickshire and Leicestershire,.........	1,500
South Welsh, (lowest estimate,)........................	60,000
Total,..	79,000

* *Burdie* is said to be a corruption of Bourdeaux, and the *house* was one in which the attendants of Mary Queen of Scots resided.

The quantity of coal annually removed from the coal-fields of the United Kingdom is about 32 millions of tons: whence it might be supposed that these beds alone would supply the wants of the English people for 2500 years, and that the entire coal areas of the kingdom would suffice for 5000 years or more. But many large deductions must be made from this estimate, to arrive at the quantity of available coal. In many places, the coal measures exceed 3000 feet in thickness. Now, coal-pits seldom descend as low as 1500 feet; the workmen are even then exposed to great danger. Moreover, it is calculated that nearly one-half of every bed of coal is lost in small coal, or left behind as supporting pillars. The reader, desirous of knowing more on this subject, may refer to page 201 of our third volume.

The carboniferous system occupies a larger proportionate area of the British Isles than elsewhere. On the continent of Europe, some peculiar varieties of rock occur in the series. Thus, in Westphalia, a black bituminous and fetid limestone is found. In Russia, a calcareous rock of a milk-white colour, very fossiliferous and full of flints, occurs in the middle of the series. Among the upper beds occurs a limestone, made up of myriads of fossil bodies, (called *Fusulina*,) resembling grains of wheat.

Coal is not the only valuable material in the carboniferous series. It is from this system that is obtained the principal supplies of British iron. Lead and zinc also occur in large quantities.

The following table represents the comparative production of iron, in 1845, in Europe and the United States of America:—

Great Britain,	2,200,000	tons.
United States,	502,000	—
France,	448,000	—
Russia,	400,000	—
Zollverein,	300,000	—
Austria,	190,000	—
Belgium,	150,000	—
Sweden,	145,000	—
Spain, (1841,)	26,000	—
Rest of Europe,	50,000	—

The quantities of lead produced in the United Kingdom, in 1847, were—

England,	39,508	tons.
Wales,	12,294	—
Ireland,	1,380	—
Scotland,	822	—
Isle of Man,	1,699	—
Total,	55,703	tons.

Magnesian Limestone, or Permian System.

"After examining the carboniferous rocks," says Professor Phillips, "the red sandstones and the associated strata present themselves with an air of novelty and freshness, not less striking to the geologist than a new country to the traveller." This system, one of whose names is derived from Permia, an ancient kingdom, extending 700 miles along the western flank of the Ural Mountains, and for nearly 400 miles between that chain and the Volga, is considered by Sir R. Murchison, by whom the district was investigated and the name assigned, to be contemporaneous with the middle and lower parts of the system as developed in England. The term saliferous was formerly applied to this and the next system, (which were then classed together,) from the fact that rock-salt occurs generally amongst these strata in Europe. But in addition to the fact that salt mines are found abundantly among strata of a different age, the fossils of the Permian system are so similar to those of the systems below, and the fossils of the upper new red sandstone have so much affinity to those of higher strata, that the former beds are now placed in the palæozoic division, and the latter in the secondary. The Permian system does not occupy large areas in England, and occurs still more sparingly in Scotland. It is seen on the edge of the northern and midland coal measures.

The uppermost English beds are composed of marls containing gypsum (plaster of Paris). The magnesian limestone beds which occur next below are very varied, sometimes being loaded with magnesia, at others being almost pure carbonate of lime. Dolomite, a soft compact rock, of a white or yellowish colour, contains about 59 per cent. of carbonate of lime, and 40 per cent. of carbonate of magnesia. It is well seen in the neighbourhood of the rivers Tees, Wharfe, and Dun. In the south, it forms a fine natural terrace, fronting the west, and sometimes reaching a height of more than 500 feet. The cause of the presence of the magnesia has not been ascertained. Some of the lower beds of the series consist of quartz crystals, covered by red oxide of iron. In the cliffs which overhang the Avon at Bristol, there is a red limestone composed of fragments of older limestone, cemented by a red or yellow magnesian paste.

The lower beds of the system are not only distinguished by their red colour, but (as is the case also with the old red sandstone) by the paucity of organic remains. The *red* sandstones of the series are almost, if not quite, destitute of such remains.

All the systems of British strata which are included in the Palæozoic epoch have now been noticed. It remains to give a general description of the fossil fauna and flora of this epoch.

Organic Remains of the Palæozoic Epoch.

Fauna:—*Mammalia.*—No remains have yet been discovered.

Birds.—Impressions, apparently of birds' feet, have been found on sandstones, attributed to the Permian age, which occur in the shale of Massachusetts.

Reptiles.—The remains of three kinds of saurian reptiles have been discovered in the magnesian limestone of Bristol. They are the Palæosaurus cylindrodon, the Palæosaurus platyodon, and the Thecodontosaurus antiquus. These animals are allied to the monitors, which occur in Egypt and elsewhere.

Fish.—Traces of fish are found in the British silurian strata. In the limestones belonging to the old red sandstone of England, their remains occur in great abundance. The numbers of species which have been made out in the carboniferous system is very great, and many yet remain to be described. Few remains of fishes occur in the British strata of the Permian age. The investigations of M. Agassiz have established some interesting points regarding fossil fish. Partly by observing a connection between the scales and the internal structure of fishes, he arrives at the conclusion that nearly all the fossil fishes belonging to the Palæozoic strata resemble the existing shark, sturgeon, and lepidosteus. Such fish have the lobes of the tail fin unequal, a peculiarity which is interesting, from the fact that the vertebral column is continued into the upper lobe, so that the longer lobe is an approximation to a reptile's tail. It is even more curious to find a still nearer approach to the reptile in a group of extinct fishes, now called sauroids. To this group belongs the megalicthys, the teeth and jaws of which are often met with in the Burdiehouse limestone. This fish (which was of immense size) possessed teeth and scales very like those of the crocodile. The group is represented among recent fishes by the genera lepidosteus and polypterus, the species of which amount in all to seven. The former occur in the rivers of North America, and the latter in the Nile and waters of Senegal. Of the fish belonging to the carboniferous age which have yet been described, there are 24 species of sauroids, 12 of ganoids, and nearly 100 of placoids. Ganoid and placoid fishes belong to the division with enamelled scales, the placoid being those which approach nearest to reptiles. By far the largest number of the 8000 known species of existing fish, belong to the division with unenamelled scales. All the fossil fish belong to extinct genera.

Mollusca.—Fossil mollusca, for the most part, belong to genera still represented. It would appear, therefore, that this division of the animal kingdom was especially able to adapt itself to change of circumstances. However, the relative proportions of the different groups have altered very much, and it is curious, though only analogous to what has already been noticed with regard to fishes, that a greater proportionate number of species then belonged to the higher types of that division than at present.

The following table compares the number of recent species of mollusca with those found extinct in all epochs:—

	Extinct.	Recent.
Brachiopoda and Rudistæ,	1146	48
Bivalve shells, not Brachiopoda,	4836	2413
Ordinary univalve shells,	6110	8673
Cephalopoda,	1546	128
Total shell-bearing animals,	13,638	11,262

It appears from this table that many more species of cephalopoda and bivalve shells have been found fossil than exist in the present seas. Now cephalopoda (which class is now represented by the cuttle-fish and nautilus) are the highest class of this division of the animal kingdom, and they occur in greater abundance, not only throughout *all* ancient strata, than at present, but also amongst strata of the earliest epoch, than in strata of a later date. The history of brachiopoda (the earliest race of animals of which we have record) is also peculiar. These are bivalve shells, resembling, in their nutritive system, the lowest of the mollusca; but in their muscular system they have a peculiarly complex structure, having a set of muscles to open, and another set to shut the valves of their shell. Only three genera are known to exist at present—terebratula,

lingula, and orbicula. The two first of these genera attach themselves to solid substances by a foot-stalk; the last is attached, like the oyster, by one of the valves of its shell. The existing species frequent the depths of the ocean, to which situation they appear to be adapted by the peculiarities of their muscular apparatus. In the ancient epochs of the world, species of brachiopoda were much more numerous than at present. Species of lingula—a genus, as we have stated, still existing—appear in the earliest rocks of the silurian age. To these succeeded many other genera. Between forty and fifty species of terebratula have been found fossil in these rocks, and altogether above a hundred different forms have been discovered. In the carboniferous age, brachiopoda were still more numerous, and belonged to peculiar genera, which are not represented in our pres nt seas.

Univalves exist in the earliest strata, but we find a greater number of species existing at present than have been found extinct throughout *all* previous epochs. We may safely conclude, therefore, that a greater number of univalves exist at present than existed in any one previous age. Moreover, we find that they increased in numbers gradually, from the earliest ages to the present time. Bivalves are also generally found to increase, as we pass from system to system to the present time.

Crustacea.—This class, which includes the lobster and crab of our present seas, was apparently represented in the earliest epoch by a kind of animal very different from the present forms. Trilobites, about twenty genera of which have been found in the silurian strata, were probably crustacea. They do not extend beyond this system, though allied genera occur among the strata of the carboniferous system.

Insecta.—Slight traces occur in the coal measures of Coalbrook Dale.

Annelides.—Of this class, which includes our present earth worms, still fewer traces could be expected than of insects. The remains of such as make shelly tubes occur in rocks of all ages.

Echino-dermata were represented in the earliest epoch by the crinoideæ, of which only a few species now exist. They were particularly plentiful during the palæozoic epoch, from which time they began to decline. Their fossils are known as encrinites.

Zoophytes are present in all the systems of the palæozoic epoch. A great variety of well-preserved forms occur in the Wenlock limestone, and they frequently form considerable masses in the limestones of the carboniferous system. On the whole, though many genera of zoophytes are common to all the epochs, those of the earliest epoch are strongly contrasted with those which occur in the later epochs.

Sponge.—Some indistinct traces of this class have been found in the silurian, Devonian, and carboniferous strata.

Flora.—There are no evidences sufficient to prove the existence of plants at a time previous to the carboniferous system. In that system the remains occur in great variety, and are often so complete as to show excellently the external appearance of the original plants, but they seldom exhibit internal structure. The following table is taken from Johnston's "Physical Atlas."

Table of Species of Plants found Fossil in Strata of the Palæozoic Epoch.

Algæ,	1	Lycopodiaceæ,	3
Fungi,	1	Glumaceæ,	1
Calamariæ,	13	Coronariæ,	1
Acrophyllites,	2	Scitamineæ,	1
Filices,	75	Coniferæ,	18
Hydropterides,	3	Calycifloræ,	2
Stigmariæ,	3	Incertæ sedes,	7
Sigillariæ,	11		
Lepidodendraceæ,	25	Total species,	159

If the number of existing species of plants be estimated at 80,000, then the flora of the palæozoic epoch amounted to 1-500th of our present flora, and the flora of the whole ancient world was 1-45th. When we review the facts thus stated, the first point which strikes us is the total absence of the highest group of vertebrata—the mammalia—from the remains of the palæozoic epoch; the almost total, if not entire, absence of all trace of birds—the next group in order,—and the occurrence of reptiles (with the exception lately noticed in Canada) at the end only of the epoch. Of animals entirely marine in their habits—fish, mollusca, and radiata—we have abundance, with a predominance of the higher forms. We might account for the non-discovery of birds and mammalia during this epoch, by supposing that no dry land existed, or that, if dry land existed and was inhabited by such animals, yet their remains would be likely to occur sparingly in marine strata, to which they could only have been conveyed by rivers and inundations, and might not yet have been met with. But since enormous masses of fossil wood, accompanied by argillaceous and sandy beds, with the remains of fish, mollusca, and radiata, have been found towards the end of this period, it is difficult to imagine how these masses of vegetation should have been swept off the land, without conveying along with them remains of land animals, if they had existed in any abundance. It is therefore extremely probable, that the highest forms of animals did not exist at the time the vegetation of the coal measures flourished. It becomes the less surprising that this should have been the case, when we can point to New Zealand, which agrees generally in its vegetation with what appears to have been the vegetation of the land which supplied the coal measures, but where no native mammals, except a kind of rat and a bat, are found. That during the early period of the palæozoic epoch no dry land existed, is a view indicated by the general inconformability between the carboniferous strata and those anterior to them. It is evident that, before the deposition of the carboniferous strata, great disturbances happened where Great Britain now rests, by which, probably, large portions of the bed of the sea were raised into dry land; for we not only find these strata unconformable with the earlier strata, but those do not appear to have been covered by later deposits. It was during these disturbances that the range of Grampian mountains, from Aberdeen to Cantyre, and most of the Highlands, are supposed to have made their appearance above the ocean. The Lammermuir hills were probably raised about the same time, and the Cumbrian mountains received one of their upward movements. These ranges have nearly the same direction (from S.W. to N.E.). A second period of disturbance must have occurred subsequent to the deposition, and before the commencement of the secondary epoch. "Every coal-field in these islands," says Professor Phillips, "is remarkably dislocated by faults;* often traversed by dykes, sometimes ridged or furrowed by anticlinal or synclinal dips." The most remarkable dislocation of this kind in Britain, is that which begins at Cullercoats, near Newcastle, passes along the valley of the South Tyne to Brampton, thence southward as far as Kirkby-Lonsdale in Yorkshire, and terminates to the eastward, near Grassington in Wharfdale, having traversed a distance of 110 miles. The land enclosed by this line is raised from 1200 to 4000 feet above the strata on the other side of the fault, so that some of the earliest silurian strata are exhibited on one side on a level with the coal measures on the other.

Geographical Character of English Rocks anterior to the Secondary Epoch.

We have already described the line which would form a boundary of all the systems, down to the end of the carboniferous, as well as the hypogene rocks found in England. This line, we may further remark, would either include or pass through the last or Permian system, so that the whole series of palæozoic rocks is pretty well marked out by it. The general character of the rocks of this early period is mountainous and wild, compared with those which will be the subject of future papers. They rise into bare mountains in Wales and Cumberland, into bleak fells in the north of England, and into elevated moors in Devonshire and Cornwall, and they spread in barren undulations over large tracts not much raised above the general level of the country.

The most prominent range of elevation in England is the Pennine ridge, composed of the lower members of the carboniferous system (mountain limestone and millstone grit). This range extends north and south, from Carter Fell, one of the Cheviot hills, to the Weaver hills, on the east border of Staffordshire—a distance of 170 miles. The highest point of the range is Cross Fell, (2901 feet above the sea,) on the borders of the three counties, Westmorland, Cumberland, and Durham. North of this high point the range is comparatively low and narrow, compared with the southern part. Its greatest width is south of the river Eden, and is probably from twenty to twenty-five miles. From this part spring the rivers which fall into the Ouse on one side, and Morecambe Bay on the other. The ridge again narrows for the south, but widens again on the borders of Derbyshire, forming the "Derbyshire Mountains." The breadth of these mountains, between Sheffield in Yorkshire, and Macclesfield in Cheshire, is about twenty-two miles. The southern extremity of the range is Weaver Hill, (1154 feet,) which stands a little to the west of Ashborne in Derbyshire. This long range of hills is generally covered with peat, earth, and heath, and its character is for the most part bleak and desolate.

The mountainous region of the northern lakes is chiefly composed of slaty rock, with some members of more recent systems wrapped round them. The highest elevation of the group is Scawfell Pike, 3166 feet above the sea.

The mountains of Wales consist of several distinct ranges, composed

* A *fault* occurs when the strata on one side of a vertical line is raised in a vertical direction, so as to break the continuity of the beds. *Anticlinal* and *synclinal* dips are illustrated by a ridge and a furrow. The two sides of the same ridge have anticlinal, the adjoining sides of different ridges have synclinal dips.

chiefly of rocks of the silurian period. They lie on the borders of a high central tract, composed of the same rocks, which occupies more than one-third of the whole country. The highest peaks of Britain, south of the Cheviots, occur in the north-western part. Snowdon is 3571 feet above the sea.

Devonshire and Cornwall have also a mountainous character, consisting generally of bleak moors of granitic rocks, which have in one place an elevation of 2000 feet. The Mendip hills in Somersetshire are chiefly composed of mountain limestone, and rise to a height of 1100 feet. The mountainous skeleton we have described, is filled up chiefly by the old, and what used to be called the new red sandstone, but is now classed under two systems, the Permian, already described, and the Triapic, which will be noticed in a future paper.

The distribution of the palæozoic strata, up to the end of the carboniferous system, was as follows:—

In Europe, these strata occur generally over small and detached areas, as compared with the hypogene rocks. The greatest development occurs in European Russia, about half of which is occupied by them.

In Asia, we find an extensive tract, occupying Siberia, between 60° and 67° of north latitude, and 90° and 120° east longitude, and also in the north-eastern part of the same country. Smaller areas appear in India and elsewhere. Africa appears to possess only small patches of these strata, which are hardly seen except in the neighbourhood of Cape Colony.

In North America we have one of the largest, perhaps the largest, continuous area in the world. It lies parallel with the western coast of that continent, and stretches from the mouth of the river Mackenzie to within a few degrees of the mouth of the Mississippi, having a width of from 10° to 15° in its northern part, but in the lower part, being south, occupying a much wider space, for it spreads over a great part of the country between the river Missouri and the mouth of the St. Lawrence. Oregon and the upper part of California consist of the same strata. *

In South America, narrow bands occur parallel with the Andean chain, and small patches in other parts of the continent.

Australia has two narrow bands, which run parallel to the eastern coast. They spread out somewhat in the southern part of the Port-Philip district.

Since this article was written, the birth of reptiles has been removed two stages back, by the discovery of a reptile, six or seven inches in length, in the crystalline yellowish sandstone of the Old Red Sandstone, near Elgin, Morayshire. It appears to have been of a peculiar type, resembling in some parts a lizard, in others a salamander. It has been called *Telerpeton Elginense*. A number of footprints of a Chelonean reptile have also been discovered in the same locality. The recent discovery of fresh-water shells and plants in the Old Red Sandstone of Knocktopher, county Kilkenny, Ireland, has added another evidence to the existence of land at that period. But the rapid progress of discovery has left the text in arrear in regard also to the carboniferous system, where reptiles of the new genera, Archegosaurus and Apateon, have been recently found, the former being a monstrous form between the toad and lizard.

ON THE MECHANICAL ARRANGEMENT OF RAILWAY TRAINS AND CARRIAGES, WITH THE OBJECT OF REDUCING RESISTANCE TO THE MINIMUM.

Our attention has been called to this subject by the remarkable difference experienced in the movement of different carriages on different lines of railway. They certainly "agree to differ," in many cases without any apparent reason, and we have been at some pains to solve the problem. We must begin at the beginning, in order to make the matter clear.

The rolling medium on a railway is a peculiar kind of wheel, keyed firmly on each end of a shaft or axle, producing, in fact, a structure equivalent to a roller with the centre cut away. The two ends of this roller, which we call the wheels, being of equal diameter, it is obvious that the tendency is to run only in a straight line, and if forcibly pulled out of the straight line, a sledging movement takes place, with a screeching sound, as those well know who have been within reach of a Portuguese or Spanish car, the so-called wheels of which are analogous in structure to that of our railway wheels.

To obviate this movement of sledging, the railway wheels are made with a very broad periphery, or tread, of four inches in width, exclusive of the guiding flange; and this tread is turned to the form of a cone, smallest on the outer diameter, and largest on the inner diameter. It is therefore obvious, that if the peripheries of the two opposite wheels be treading, one on the smallest diameter, and the other on the largest, the pathway described in a revolution will be considerably longer with the wheel resting on the largest diameter, than that with the wheel resting on the smallest diameter. In such case, the tendency of the wheels will be to run in a curved line. But supposing the distance between the rails to be exactly the same as the distance between the flanges of the wheels, it is obvious that in such case the wheels cannot change the diameter of their tread, and that, if urged to run in a curved line, they can only do so by a sledge movement. The difference of diameter on each wheel, at the flange and at the outer edge, is about half an inch. Therefore, two radial lines drawn from the large diameter of one wheel to the small diameter of the other wheel, would meet at a point describing the centre of the curve round which the wheels would traverse were they permitted to act. Thus the difference in diameter of the conical-formed peripheries—about half an inch—could they act to their full extent, would enable them to turn a curve of about 400 feet radius, by mere rolling movement without friction. But the width of the rail being two inches and a half, and the tread of the wheel only four inches, the extreme movement laterally could only be two and three-quarter inches, supposing the wheel were permitted to bring its external periphery to the centre of the rail, which is not the case, as, practically, the difference in width between the flanges and the rails is commonly half an inch, and never more than an inch, till hard wear has lessened the thickness of the flanges and the width of the rails. The curves of points and crossings are usually set out to 400 feet radius, the extreme of the wheels' possibility, if space were allowed; but as space is not allowed, it follows that the wheels cannot get round without considerable friction, and it is probable that with new wheels and new points not polished, this may be one cause of getting off the line, and with old wheels, worn hollow on the tread, it must be still more perilous.

But what are called curves, in railway parlance, are very different things from the practical curves not intentionally made. The inequalities of the rails' level, even when the joints are good, are equivalent to an incessant variation of sharp curves and angles, which the wheel cones are incessantly trying to equivalate till stopped by the blows against the alternate flanges. If this be doubted, let a four-wheel carriage, not unnecessarily heavy, be loosely attached by its traction-rod to an engine, at thirty to forty miles per hour, and if it be not shaken off the rails, it will shake the passengers very uncomfortably. If, then, a second carriage be attached to the first, and the buffers be screwed up very hard together, the oscillation will be much checked, but the resistance to draught will be increased; and if the carriages be all sufficiently long, the wheel flanges will rapidly wear, and the axle brasses will also get a lateral movement, permitting the wheels to recoil from the blows against their flanges, wasting the grease, and getting the whole machinery out of order, with very considerable peril of getting off the line. Meanwhile, the carriage is a sledge, and not a rolling body in the proper sense of the word. When the wheels are worn hollow on the tread, all this mischief is multiplied. The friction on the buffer-heads sufficiently indicates the mechanical difficulty.

It is obvious that the play or movement laterally, between the flanges and the rail, are insufficient, unless the wheels could be made six to seven inches wide on the tread, and four inches play be permitted. But all experiments that have been hitherto made to obviate this, have been so badly made, that it would almost seem as though it had been intended to discredit a sound principle.

A railway passenger train, if all loosely connected, would have each carriage running alternately to right and left, the wheels seeking to avoid friction by selecting the best path. But as the wheels are confined in the same plane as the carriage by the axle guides, the carriage moves laterally with them, and partakes of the shocks of the flanges against the rails. Passengers complain of this; and the whole train is screwed tightly together, and becomes a long, laterally elastic sledge, and the tighter it is screwed, the more sledge-like it becomes. The glistening line of the rails, and the polish on the tyres, indicate this clearly enough, and the difficulty of arresting the gliding movement by the breaks which stop the wheels is a further proof. After a certain amount of running, the wheels get loose laterally, and then the alternate action of the buffers to right and left produces a more unpleasant movement than ever. Under such circumstances, we once heard a *bon vivant* congratulate himself, that he was not "a dozen of crusted port."

It was by reasoning in this fashion, that Mr. W. Bridges Adams became satisfied of the absolute necessity of leaving all railway carriage wheels to their own guidance, in no way shackling them in their pursuit of the path of minimum friction.

The next step in progress was to hang the carriages on a new class of springs, perfectly elastic, passing through ample space, and yielding in every direction to concussion. The wheels were set free laterally, and

perfect ease of movement was attained. But in those days twenty miles per hour was the limit of speed. Forty miles were required, and it became impracticable to run a four-wheeled carriage with free wheels. But the very springs which were impracticable in England with short four-wheel carriages, were extensively used in Germany on long carriages with six wheels, being preferred to all others. Still, at high speeds, the long six-wheel carriage oscillated at times, and its great length made it objectionable in other respects, as in case of repairs. It was quite clear that length and breadth, as in a steamer at sea, were the elements of steadiness, and Mr. Adams solved the problem of facilitating structure and repairs, while attaining the ease of carriages longer than had ever before been produced, by bolting together two four-wheel carriages, so as to form a single carriage, in which the wheels were arranged to move laterally to either side, a distance of four inches—eight altogether—and in this mode, the carriage being on eight wheels, was enabled to pass round curves of as sharp radius as short four-wheel carriages, and the wheels, on all ordinary curves, were enabled to roll without friction.

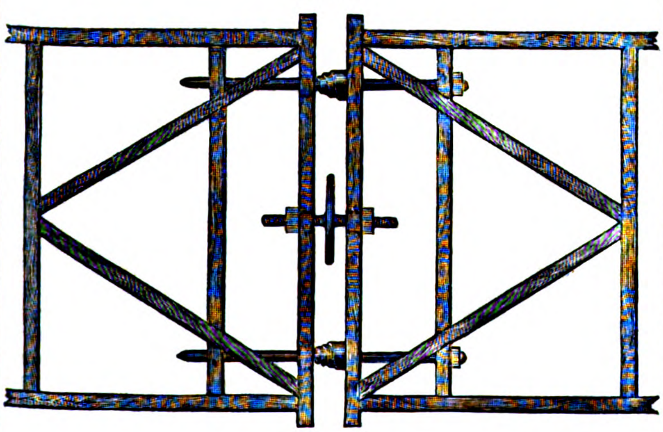
The advantages of such a structure are obvious:—

1. Draught resistance is lessened, as well as the wear of wheel tyres and rails.
2. Steadiness and freedom from oscillation are attained.
3. As no pitching movement can take place, the springs are less liable to be broken, and they may be made much lighter and more elastic, and will at the same time carry a larger load.
4. The wheels, by reason of their free movement, are less liable to escape from the rails.
5. In case of collision, or getting off the rails, the carriages are not likely to upset, or rise one above the other, or turn over, and therefore passengers are much safer.

As a modification of this principle, to carry curvilinear movement to a greater extreme, two carriages may be jointed by vertical hinges, so as to permit them to bend laterally with short buffer-rods and springs, or other similar arrangement.

Another modification is to enter the buffer-rods from one carriage to another, *permitting lateral movement by slot holes*, so as to use ordinary

Fig. 1.



½ inch = 1 foot.

carriages, and procure steadiness without vertical oscillation, and so that the carriages may be used without going to the expense of alteration for lateral movement in the wheels. Fig. 1 is a plan of portions of the framing of two carriages fitted in this manner. On the same principle, the buffer-rods of ordinary carriages may be bolted together if required; but this Mr. Adams does not advise, as without some lateral sliding between the two carriages, the wheels would be exposed to friction, and destroyed more rapidly than would be desirable, though vertical steadiness would be attained at the cost of much greater haulage power.

In cases where it is desirable to have carriages coupled to form one carriage, or support each other vertically, and yet be used separately when required, the best arrangement is to connect the buffer-heads by a double-centred coupling, so that the carriages may slide laterally past each other; and in this case the buffer-rods may be provided with both buffing and tractive springs, and they may serve as draw-rods, and without needing coupling chains. Fig. 2 is a plan, and fig. 3 a corresponding sectional elevation, showing this modification.

Fig. 2.

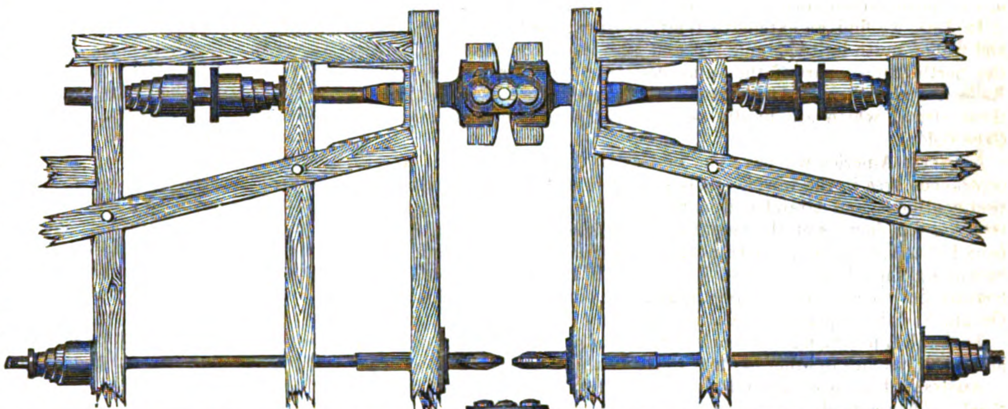


Fig. 3.

½ inch = 1 foot.

This last arrangement is very desirable for existing waggons, for it would enable them to carry one-third more load without distressing the springs or roadway. In the case of coals or other heavy cargoes, this would be very important, and in the case of goods, the springs might be so lightened as to diminish draught and save wear.

Apart from the question of mechanical arrangement and advantages as a machine, this mode of structure offers great facilities for passenger accommodation. Where the width of intermediate rail spaces will permit it, the carriages, even on the narrow guage, may be advantageously increased to two feet in width. In such case, free passage-way for the guard to the driver might be permitted through the whole interior of the train, avoiding many causes of danger and annoyance. The first-class cabins could be partitioned off in seats for four on each side the passage way. Again, the whole interior of the double carriage might be a saloon; and further, refreshments might be supplied in the train for long journeys, without need of stopping, except for water, so as to save loss of time; and by means of the width and length, the steadiness would be so great that the carriages might permit of height, to allow passengers to stand up on a journey—no slight source of ease when weary with sitting. In saloon construction, there is the element of a source of safety in case of collision which we have never seen pointed out; it affords facilities to seat passengers sideways. Now, supposing each passenger to be seated thus, between two firm elbows, in case of collision, he would not be thrown out of his seat, to strike the opposite passenger in the face. It would be "shoulder to shoulder," and it is probable no injury would be sustained. For warmer climates, the larger the railway carriages can be constructed the better.

We are satisfied that this system of eight-wheel vehicles is destined to play a very important part in railway economy, and more especially in the greater accommodation that will every day be demanded by the public. A very few years will make us regard with wonder the present modes of structure destined to become obsolete.

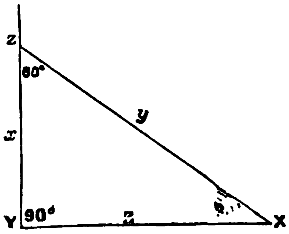
GENERAL VIEW OF TRIGONOMETRY,

By J. G. B. Marshall, B.A., C.E.

III.

The first requisite practical application of trigonometry is to find numerical values for the different trigonometrical functions or lines for all values of the arc or angle. To do this for each particular case, just as such values are needed, would involve the practical man and even the student in endless trouble. For the purpose of obviating this, tables are constructed in which the successive values of the lines are separately registered for all angles from 0° to 90°, to an assumed radius and a common difference of 1″ or 1‴ or &c., in the value of the arc or angle, according to the degree of accuracy sought. It has already appeared that these values can easily be adapted to any other radii; and also, that with such tables all the cases of right-angled triangles might even now be solved. But though it yet remains to show how such tables are constructed, the student may, with advantage, consider one or two cases involving the method of solving such cases generally.

Fig. *a.*



(Fig. *a.*) If y be given $= 10$ feet, and the angles as represented, the sides x and z may be found. For when y is radius, $z = \cos. 30°$ and $x = \text{sine } 30°$. But when radius $= 1$, the sine of $30° = \frac{1}{2}$, as we have seen; and also as $1 : \frac{1}{2} :: 10 : x = 5$ feet, and similarly as $1 : \sqrt{\frac{3}{4}} :: 10 : z \therefore z = 8{\cdot}6$, &c., feet.

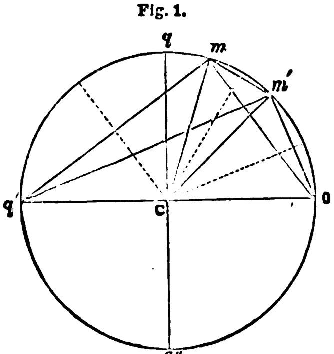
If z were given $= 10$ feet, x would be $\tan. 30° = \frac{1}{2} z$, or 5 feet, and y would be the secant of $30° = 11{\cdot}1$, &c., feet.

So also, when the sides are given, the angles may be found. Thus, if y be 10 feet and x 5 feet, as $y : x :: 1 : \text{sine X}$, or $10 : 5 :: 1 : \text{sine X} = \frac{1}{2}$; but $\frac{1}{2}$ is sine of 30° when radius is unity; and so likewise might any other angle or arc be found from the number expressing the relation of some trigonometrical line belonging to that arc to radius, provided we knew how to find the angle corresponding to such relation. Thus we know that the angle or arc of 30° corresponds to the relation of its sine, being one-half of radius. Many other particular cases we have also seen to be determinate, as it were, *a priori;* and in tables, each angle would be read out, as soon as its sine, cosine, or tangent, or &c., were determined. Leaving the student to practise a few more cases of the right-angled triangle, such as the isosceles—that right-angled triangle which has one angle of 18°, or some other of the particular angles whose sines, &c., we stated in a previous chapter—we now come to the investigation of what are called the *fundamental formulæ.*

If the diameter be 10,000 feet, the circumference is 314,159 feet, and the length of one second of such a circumference would be ·24, &c., feet. This may be taken as the sine of such an arc, and from this sine all the other lines may be determined. But from this, the sine of an arc of the same circle, containing more than one second, could not be found.

By the following process, however, formulæ and relations are determined, which furnish easy means of calculating all the successive lines when one is thus known; and at the same time, series, &c., derived from this fundamental principle, serve as checks and verifications, as well as for the purpose of abridging the labour of forming trigonometrical tables. The analysis and its revelations are, moreover, of great importance, and capable of elegant application in still higher mathematics.

Fig. 1.



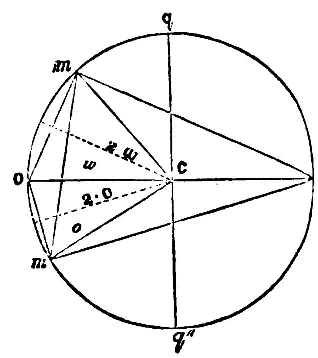
The object now sought is to express the sines, cosines, &c., of the sum and difference of two arcs, in terms of those of the single arcs.

Let $o\,m$ and $o\,m'$ be any two arcs of the circle $o\,q\,q'\,q''$; call $o\,m$, 2 *omega* (ω), and $o\,m'$, 2 *omicron* (o). Draw the lines shown in figure 1—$o\,m\,q'\,m'$ is a quadrilateral figure inscribed in a circle. By the well-known theorem of Ptolemy—that the rectangle contained by the diagonals of a quadrilateral figure inscribed in a circle is equal to the sum of the rectangles contained by its opposite sides—$q'\,o \cdot m\,m' = m\,o \cdot q'\,m' + m'\,o \cdot q'\,m$. But $q'\,o =$ twice the radius $= 2$, and $m\,m' =$ the chord of $2\,(\omega + o) =$ twice the sine of half that arc $= 2 \text{ sine } (\omega + o)$; $m\,o =$ the chord of $2\,\omega =$ twice the sine of ω; $q'\,m' =$ chord of supplement of twice $o = 2$ sine of half that supplement $= 2 \cos. o$; $o\,m' =$ chord of $2 \cdot o = 2 \text{ sine } o$; $q'\,m =$ chord of supplement of $2 \cdot \omega = 2 \cos. \omega$. Therefore, by substitution of these values $2 \times 2 \text{ sine } (\omega + o) = 2 \cdot \text{sine } \omega\ 2 \cos. o + 2 \cos. \omega\ 2 \text{ sine } o$; and dividing each simple factor by 2, $\text{sine } (\omega + o) = \text{sine } \omega \cdot \cos. o + \cos. \omega \cdot \text{sine } o\ (f)$.

Now, as ω and o may have any values whatever, this relation is true of any two arcs whatever. When $\pi = 180°$, $\frac{\pi}{2} = 90°$, $\cos. (\omega + o) = \text{sine } \left(\frac{\pi}{2} - \overline{\omega + o}\right)$ since these arcs are complements mutually to each other. But by the preceding relation (f), $\text{sine } \left(\overline{\frac{\pi}{2} + \omega} + o\right) = \text{sine } \left(\frac{\pi}{2} + \omega\right) \cdot \cos. o + \cos. \left(\frac{\pi}{2} + \omega\right) \cdot \text{sine } o$; also, from what has already been premised, $\text{sine } \left(\frac{\pi}{2} + \omega\right) = -\cos. \omega$, and *vice versâ.* This also is true of any arc; wherefore, of $\frac{\pi}{2} + (\omega + o) \therefore -\cos. (\omega + o) = \text{sine } \left(\frac{\pi}{2} + \omega + o\right)$. Hence, by substitution of these values in the formula written above, $-\cos. (\omega + o) = -\cos. \omega \cdot \cos. o + \text{sine } \omega \cdot \text{sine } o$; and changing the signs, $\cos. (\omega + o) = \cos. \omega \cdot \cos. o - \text{sine } \omega\ \text{sine } o\ (f')$.

Fig. 2. Now, let $o\,c\,m = 2\,\omega$, $o\,c\,m' = 2 \cdot o \therefore m'\,c\,m = 2\,(\omega - o)$. Draw the chords, &c., as before, and by the same theorem, calling $o\,c\,m = \omega$, and $o\,c\,m' = o$.

Fig. 2.



$q'\,o \cdot m\,m' = o\,m \cdot q'\,m' - q'\,m \cdot m'\,o.$

That is, $2\,r \,.\, 2 \text{ sine } (\omega - o) = 2 \text{ sine } \omega \cdot 2 \cos. o - 2 \cos. \omega \,.\, 2 \text{ sine } o$; $\text{sine } (\omega - o) = \text{sine } \omega \cdot \cos. o - \cos. \omega \cdot \sin. o\ (f°)$; (as before).

$\text{Cos.} (\omega - o) = \sin. \left(\frac{\pi}{2} - \omega + o\right)$ —its complement—and by formula $(f) = \sin. \left(\frac{\pi}{2} - \omega\right) \cos. o + \cos. \left(\frac{\pi}{2} - \omega\right) \sin. o$. But $\left(\frac{\pi}{2} - \omega\right) =$ the complement of $\omega \therefore \cos. (\omega - o) = \cos. \omega \cos. o + \sin. \omega \cdot \text{sine } o\ (f°')$.

These formulæ may now be collected and written out consecutively, for the sake of clearness—the radius, being considered *unity*, is omitted, as usual in algebraic expressions.

$$\text{Sine } (\omega + o) = \text{sine } \omega \cdot \cos. o + \cos. \omega \cdot \text{sine } o. \qquad (f)$$
$$\text{Cos. } (\omega + o) = \cos. \omega \cdot \cos. o - \text{sine } \omega \cdot \text{sine } o. \qquad (f')$$
$$\text{Sine } (\omega - o) = \text{sine } \omega \cdot \cos. o - \cos. \omega \cdot \text{sine } o. \qquad (f°)$$
$$\text{Cos. } (\omega - o) = \cos. \omega \cdot \cos. o + \text{sine } \omega \cdot \text{sine } o. \qquad (f°')$$

And on these four equations, thus derived from a simple geometrical principle, may be founded an innumerable series of others, which furnish all requisite data to trigonometrical calculations.

Since sine divided by cosine = tangent, the value of the sine, divided by the value of the cosine, gives the value of the tangent $\therefore$ from f and f', reducing by the common measure $\cos. \omega \cdot \cos. o$ $\tan. (\omega + o) =$

$$\left(\frac{\text{sine } (\omega + o)}{\cos. (\omega + o)} = \frac{\text{sine } \omega \cdot \cos. o + \cos. \omega \cdot \text{sine } o}{\cos. \omega \cdot \cos. o - \text{sine } \omega \cdot \text{sine } o} = \right) \frac{\tan. \omega + \tan. o}{1 - \tan. \omega \cdot \tan. o} \quad (d)$$

or using the common measure, $\text{sine } \omega \cdot \sin. o$, this becomes $\dfrac{\cot. o + \cot. \omega}{\cot. o \cdot \cot. \omega - 1}$

In the same manner, $\dfrac{\sin. (\omega - o)}{\cos. (\omega - o)} = \dfrac{\sin. \omega \cdot \cos. o - \cos. \omega \cdot \cos. o\ (f')}{\cos. \omega \cdot \cos. o + \sin. \omega \cdot \sin. o\ (f'')}$;

and using the common measure $\cos. \omega \cdot \cos. o$ in the second number, this becomes—

$$(d°) \quad \tan. (\omega - o) = \frac{\tan. \omega - \tan. o}{1 + \tan. \omega \cdot \tan. o} = \frac{\cot. o - \cot. \omega}{\cot. \omega \cdot \cot. o + 1}$$

by the com. meas. $\sin. \omega \cdot \sin. o$.

By a similar simple reduction, combining the two for brevity by ambiguous signs, and using the same common measures—

$$(d') \quad \left\{ \frac{(\cos. \omega \pm o)}{(\sin. \omega \pm o)} = \frac{\cos. \omega \cdot \cos. o \mp \sin. \omega \cdot \sin. o}{\sin. \omega \cdot \cos. o \pm \cos. \omega \cdot \sin. o} = \cot. (\omega \pm o) \right.$$

$$= \frac{\cot. \omega \cdot \cot. o \mp 1}{\cot. o \pm \cot. \omega} \text{ or } 1 \mp \cot. (\omega \pm o) = \frac{1 \mp \tan. \omega \cdot \tan. o}{\tan. \omega \cdot \pm \tan. o}.$$

This process continued, would furnish expressions for all the lines of the sums and differences of two arcs. The student had better attend to this a little more, and also to the annexed practical examples, intended merely to familiarize him with the formulæ: he must refer to the figures of the previous articles in reading this.

By similar triangles, sec. of any arc $(w \pm o) : r :: r : \cos. (w \pm o)$ $\therefore$ sec. $(\omega \pm o)$, cos. $(\omega \pm o) = r^2 = 1 \therefore \sec. (\omega \pm o) = \frac{1}{\cos. (\omega \pm o)}$ $= \frac{1}{\cos. \omega \cdot \cos. o \mp \text{sine } \omega \cdot \text{sine } o}$, or, dividing by the common measure, cos. $w \cdot$ cos. o, observing that, as shown above, $\frac{1}{\cos.}$ = secant.

$$(d') \qquad \text{Sec. } (\omega \pm o) = \frac{\sec. \omega \cdot \sec. o}{1 \pm \tan. \omega \cdot \tan. o}$$

By similar triangles, sec. = tan. $\times$ cosec. $\therefore$ taking cosec. $\omega \cdot$ cosec. o as common multiplier in transforming this (d') equation, sec. $(\omega \pm o) = \frac{\sec. \omega \cdot \text{cosec. } \omega \cdot \sec. o \cdot \text{cosec. } o}{\text{cosec. } \omega \cdot \text{cosec. } o \mp \sec. \omega \cdot \sec. o}$; but by similar triangles, cosec. : r :: r : sin. $\therefore$ cosec. $(\omega \pm o) \times$ sin. $(\omega \pm o) = 1 \therefore$ cosec. $(\omega \pm o) = \frac{1}{\sin. (\omega \pm o)} = \frac{1}{\sin. \omega \cdot \cos. o \pm \cos. \omega \cdot \sin. o}$

Reducing this by (sin. $\omega \cdot$ sin. o) it becomes $= \frac{\text{cosec. } \omega \cdot \text{cosec. } o}{\cot. o \pm \cot. \omega \cdot} =$ cosec. $(\omega \pm o)$.

Multiplying by sec. $w \cdot$ sec. o, and substituting cosec. for its equal cot. sec.

$$(d'') \quad \text{Cosec. } (\omega \pm o) = \frac{\sec. \omega \cdot \text{cosec. } \omega \cdot \sec. o \cdot \text{cosec. } o}{\text{cosec. } o \cdot \sec. \omega \pm \sec. o \cdot \text{cosec. } \omega}$$

To illustrate the interpretation of formulæ, take particular values for ω $(= 45°)$ and o $(= 30°)$.

Therefore, sine $\omega° =$ cosine $\omega° = \sqrt{\frac{1}{2}} = \cdot 7$ &c.; also sine $o° = \cdot 5$, and cosine $o° = \cdot 86$, &c. Hence sine $(\omega + o)$ = sine $75°$ = sine $\omega°$ cosine o + cosine ω sine o $(f) = \cdot 7 \times \cdot 86 + \cdot 7 \times \cdot 5 = \cdot 95$. So likewise sine $(\omega° - o°)$ = sine $15°$ = sine $\omega°$ cosine $o°$ — cosine ω sine $o = \cdot 7 \times \cdot 86 - \cdot 7 \times \cdot 5 = \cdot 25$, &c. $(f°)$.

By similar substitutions, the cosines of these arcs of 75° and 15° may be found; and by assigning the new values $\omega = 75°$, and $o° = 15°$, the sine of their sum, or of 90°, may be determined; and it will be found equal to unity (*q. p.*)—that is, as nearly as the accuracy of our decimals entitles us to expect—which we know is its value *a priori*.

By continuing the same line of substitution for practice, and making $\omega = 18°$, and $o = 15°$, both whose sines and cosines are now known, the sine, cosine, &c., of 3°, their difference may be found. Again, making $\omega = 20°$, and $o = 18°$, the sine, &c., of 2° may be found, and from these again the trigonometrical lines of 1° may be determined; and still continuing the process, a very great variety of lines may be calculated from even these first formulæ, all which serve as checks and verifications in the subsequent process, by which complete tables are constructed.

From the formulæ for tangents and cotangents of the sum and difference of two arcs, some nice relations may here be observed.

The tangent of the supplement of an arc has been shown to be equal to *minus* the tangent of that arc. Let ω' be the supplement of $(\omega + o)$; therefore, tan $(\omega + o) = -$ tan. $\omega' = \frac{\tan. \omega + \tan. o}{1 - \tan. \omega \cdot \tan. o} \therefore \tan. \omega +$ tan. o = — tan. ω' + tan. $\omega' \cdot$ tan. $\omega \cdot$ tan. o, or tan. ω' + tan. ω + tan. o = tan. $\omega' \cdot$ tan. $\omega \cdot$ tan. o; and similarly, cot. ω' + cot. ω + cot. o = cot. $\omega' \cdot$ cot. $\omega \cdot$ cot. o. But any angle of a triangle is the supplement of the sum of the other two angles, hence these formulæ characterize the angles of every triangle. The student should apply them to some triangle, whose angles, and therefore their tangents, he has determined separately.

The following simple and beautiful relation also offers a most important means of abridging the labour of forming tables, and of enabling any person to test the accuracy of those which he may be using or forming:—

When $\omega = 45°$, sine ω = cosine $\omega = \sqrt{\frac{1}{2}}$.

Also, sine $(45° + o)$ = cosine $(45° - o)$ = sine $45° \cdot$ cosine o + cosine $45°$ sine $o = \sqrt{\frac{1}{2}}$ (cosine o + sine o) (f and $f°$).

So likewise cosine $(45° + o)$ = sine $(45° - o) = \sqrt{\frac{1}{2}}$ (cosine o — sine o) $(f' f'')$.

If we combine these two formulæ by ambiguous signs for brevity, and multiply each side of the equation there written by double itself, we get cosine $(45° \mp o)$ = sine $(45° \pm o) = \sqrt{\frac{1}{2}}$ (cos. o ± sine o) and 2 cos.^{2} $(45° \mp o)$ = 2 sine $^2(45° \pm o)$ = cos. ^2o + sine $^2o \pm 2$ sine $o \cdot$ cos.° $= 1 \pm 2$ sine $o \cdot$ cos. o.

Also tan. $45° = 1 \therefore$ tan. $(45° \pm o) = \frac{1 \pm \tan. o.}{1 \mp \tan. o.}$

When $\omega = 60°$, cos. $\omega = \frac{1}{2}$, and sine $\omega = \sqrt{\frac{3}{4}}$, when $o = 30°$ cos. o $= \sqrt{\frac{3}{4}}$ and sine $o = \frac{1}{2} \therefore$ sine $(\omega + o)$ = sine $(60° + 30°)$ = sine $90°$ $= 1 = \sqrt{\frac{3}{4}} \cdot \sqrt{\frac{3}{4}} + \frac{1}{2} \cdot \frac{1}{2} = 1$; sine $(w - o)$ = sine $30° = \sqrt{\frac{3}{4}} \cdot \sqrt{\frac{3}{4}}$ $- \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{2}$; and so of the cosines.

When $\omega \cdot = 45°$, sine $45°$ = cosine $45°$, and tan. $45° = 1$ or radius $\therefore$ sine $(w \pm o)$ = sine $(45° \pm 30°)$ = sine $75°$, or sine $15° = \sqrt{\frac{1}{2}} \cdot \sqrt{\frac{3}{4}}$ + or — $\sqrt{\frac{1}{2}} \cdot \frac{1}{2}$, or in decimals, which are always preferable.

Sine $75° = \sqrt{\cdot 5} \times \sqrt{\cdot 75} + \sqrt{\cdot 5} \times \cdot 5 = \sqrt{\cdot 375} + \sqrt{\cdot 5} \times \cdot 5 =$ $\cdot 30647$, &c.

Sine $15° = \sqrt{\cdot 5} \cdot \sqrt{\cdot 75} - \sqrt{\cdot 5} \times \cdot 5 = \cdot 08287$, &c.

Cos. $(60° \pm 30°) = \frac{1}{2} \cdot \sqrt{\frac{3}{4}} \mp \sqrt{\frac{3}{4}} \cdot \frac{1}{2} = o$ — (the cosine of 90°), or $\sqrt{\frac{3}{4}}$ = (cos. 30°) (= 1 — sine ^{2} 30°).

Knowing the sine and $\therefore$ cosine of 15°, we find the tangent: cos. $15° = \sqrt{\cdot 993132} = \cdot 99656$, &c.

$\therefore$ tan. $15° = \cdot 0831$, &c.

$\therefore$ from formula (d) tan. $(45° + 15°)$ = tan. $(60°) = \frac{1 \cdot 0831}{1 - \cdot 0831}$ $= \cdot 116$, which may be proved by the equation, tan. $60°$ = sine $60° \div$ cosine $50° = \sqrt{\frac{3}{4}} \div \frac{1}{2}$.

When r = 10,000 feet or inches, &c.
Sine 45° = cos. 45° = 7071 feet, &c.
Sine 60° = 8662, cos. 60° = 5000 feet, &c.
Sine 30° = cos. 60° = 5000 feet, &c.
Cos. 30° = sine 60° = 8662 feet, &c.
$\therefore$ Sine 75° = cos. 15° = 9660 feet, &c
Cos. 75° = sine 15° = 2589 feet, &c., omitting decimals.

The student should tabulate a series of values of the various trigonometrical lines in this way, for as many arcs as the materials already furnished enable him. No difficulty can arise in doing this, since he only requires, in seeking the lines belonging to an arc consisting of the sum or difference of two others—the lines belonging to which are now within his reach—to combine the lines of the single arcs by the formulæ.

Enough has been said to prove the beauty, advantage, and simplicity of this method. Having mastered the practice of these fundamental formulæ, the transition is easy to what may be called derivative formulæ and series—being obtained from those now established by easy processes and analyses—to which we next proceed.

NASMYTH'S DIRECT-ACTION SUCTION FAN FOR MINE VENTILATION.

This invention is no longer a mere speculation, but a veritable fact. The example of it, as shown in the annexed drawings, is erected at one of Earl Fitzwilliam's pits, near Rotherham, where, nightly and daily, it performs its work with unceasing satisfaction.

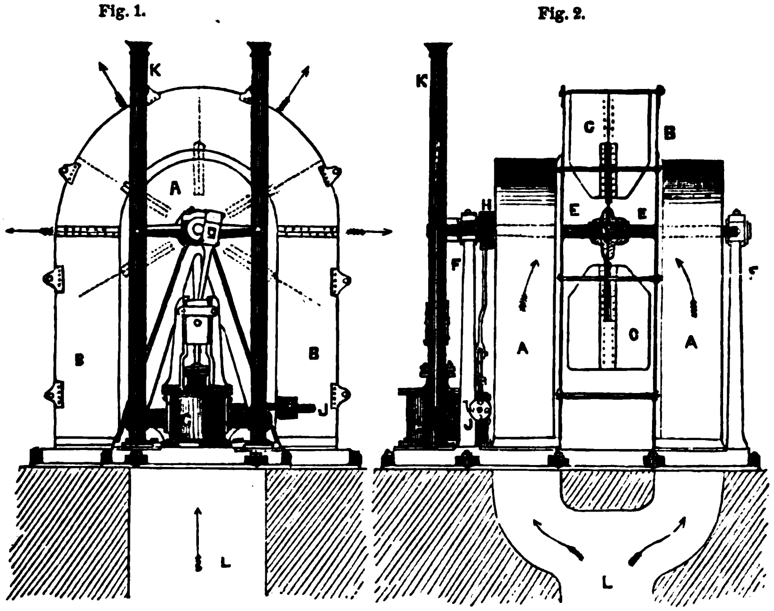
The chief peculiarities of the contrivance consist, in the first place, in the absolutely *direct* manner of communicating the power of the engine to the fan spindle, the engine crank being placed at once upon that spindle; and, secondly, in the absence of all rim or cover on the fan case, the air being discharged free, and at once, all round, as indicated by the radiating arrows. Fig. 1 is a front external elevation of the fan, looking on the actuating engine, and fig. 2 is a corresponding side or edge view. The apparatus consists of two vertical side chambers, A, with rounded tops, and bolted down to a substantial base plate, the two inner and contiguous sides of these chambers having attached to them extended side or air-guide plates, B, extending out to the entire diameter of the fan blades, C. These plates have eyes on their edges for the reception of cross stays, which are bolted up to strengthen and connect the chambers. The fan blades are six in number; they are simply rectangular plates of iron riveted to a disc of plate-iron—which disc also serves the purpose of preventing the opposite currents of air passing into the fan from interfering with each other—bolted at the centre, between the two halves of a boss fast on the shaft, D. This shaft—at once the engine and the fan shaft—passes through the side chambers in the centre of their air-discharging ducts, E, and is carried in end bearings in the tops of the side standards, F, bolted independently upon the base. The steam cylinder, G, is short-stroked for the attainment of great speed, and its piston slide-block is guided in a simple manner by a pair of guides bolted on the cylinder cover. Its slide-valve is on the inside, out of the way, and is worked by the eccentric, H, on the crank-shaft. The steam from the boiler enters by the copper pipe, J, fitted up with an adjustable stop-

U

valve, and a free and copious exhaust is secured on both sides of the cylinder, by side branches opening into the vertical funnels, K.

The foul air from the up-cast shaft is conveyed to the large openings, E, through the side chambers, which are open at their base to communicate with the main passage, L, in connection with the up-cast, either by brattice or by covering the up-cast, as the arrangements of the up-cast permit. The efficiency of the plan may be determined by any one who visits the Skiers' Spring Pit, near Wentworth, Rotherham. The expenditure of fuel, for obtaining a current of air through the workings in this way, is not one-sixth of that which was at one time consumed in the furnace at the bottom of the shaft, leaving out of question the advantage of the absence of all smoke and superfluous gases, which in the furnace system did so much damage to the iron-work and ropes. The fan, being on the surface, may be seen to be in action, and doing its duty at all times, whilst the rate of ventilation may be controlled with the greatest ease. The mechanical advantage and ease of working this fan increases with the size.

Fig. 1. Fig. 2.



1-48th.

The annexed letter and official statement tell their own story:—

JAMES NASMYTH, ESQ., BARNBRO HALL, *August* 16, 1852.

DEAR SIR,—Enclosed I send you the result of minutes taken as to what your fan at Skiers Spring is doing, and of which you can make what use you like. I may, however, remark, that in our ironstone pits, with the steam at 10 lbs., we have more air than we require, and we are even then obliged to shut a part of it off. We also find a still greater advantage from this mode of ventilation, in having the drawing shafts free from smoke, soot, and steam, by which the wood and iron work in the pit, and also ropes, were much injured. J. HARTOP.

Particulars of the measurement of air passing through the Frankersley ironstone mine, at Skiers Spring, by the agency of Mr. Nasmyth's fan, as measured by Mr. Biram's instrument :—

August 9, 1852.

	Size of Air-Gate.	Cubit Feet of Air per Minute.	Situation.
South Side, 300 Yards from the Up-cast Shaft.	5·6 × 4·3	2944	Farthest broad gate after the air had passed the length of the level.
	3·8 × 3·8	3489	Farthest broad gate when the air was not passed to the end of the lever.
Steam at 10lbs. at which we work the Pumping-Engine.	area, 30 ft. 6 in.	4240	Whole intake of south side.
	4·4 × 5·3	4125	Nearest bank face.
	3·10 × 4·3	4471	Whole return of south side.
North Side.	3·0 × 3·6	5250	Whole return of north side.
Whole Return.	5·0 × 4·2	9435	Whole return of both sides.
With Steam at 15lbs., the Whole Return was		11960	

The awful frequency of those terrible accidents which sweep away their scores of victims down in the bowels of the earth, and leave overhead nothing but a wretched group of lamenting wives and wailing children, gives all of us abundance of material for contemplative reflection. Surely, if the simple apparatus, which we have just described, is as effective in practice as we suppose it to be, there is, at least, one more safeguard for those whose lot it is to labour in darkness and in peril.

COLEMAN'S IMPROVEMENTS IN SPRINGS, AND IN THE APPLICATION OF ELASTIC MATERIALS.

(*Illustrated by Plates* 107 *and* 108.)

The circle of the practical applications of the two vegetable gums, caoutchouc and gutta percha, widens with far greater rapidity than that of any other known substance. Each day brings us a new use for them, and each successful use leads to the subjection of some acknowledged difficulties in mechanical construction. The essential peculiarities of caoutchouc long since pointed to that material as suitable for the production of an elastic movement in mechanical contrivances, as well as for deadening concussion, and the formation of elastic yielding bearings in situations where unyielding surfaces come into either statical or dynamical contact. But we have yet to feel the benefits of its adaptation to an infinite variety of purposes, both in the chemical and in the constructive arts. The eye of theory has already scanned, but the hand of practice has not yet reached, thousands of applications, to which our railways and our telegraphs are contributing to hasten us. Railways alone —as we are now reminded by Mr. Coleman—are large consumers of such materials, and with the improvements now proposed, the demand must be greatly increased.

Mr. Coleman applies both caoutchouc and gutta percha, and such compositions as contain one or other of these matters, in the manufacture of buffers, bearing and draw springs, in such manner that the elastic action is obtained from single, solid, elastic cylinders, so arranged that they may be used either alone, or in combination with air or water, or both, enclosed in the cylinder—instead of using a series of cylinders or discs, alternated with metal, as at present. These are the essential characteristics of his invention, but the subject branches off into a multitude of channels, and is best illustrated by the figures on our plates 107 and 108.

Fig. 1, on plate 107, is a vertical section and plan of a locomotive engine bearing-spring, as fitted to the upper side of the main longitudinal frame, A, instead of the ordinary overhead laminated or plate-spring. The vertical supporting links, B, hinged to the frame at their lower ends, carry two cross bars, C D, by means of eyes in the latter, entered loosely over the links; and between these bars is placed the solid india-rubber cylinder, E, the actual bearings of the two ends of this cylinder being against the flat metal discs, one of which is represented at F, in the plan. The central rod, G, which passes through the cross bars, metal discs, and elastic cylinder, descends through the frame to the axle-bearing of the engine, so that whatever shocks arise from the inequality of the road, are taken off by the interposition of the elastic cylinder between the axle and the frame, the lower cross bar, D, resting upon a collar formed upon the rod, G. The internal surface or bore of the cylinder, E, is kept distended and free from contact with the rod, G, by a helical coil of wire, so that as the rod works up and down, as the india-rubber is compressed and extended, all frictional contact is removed. Two metal rings encircle the elastic cylinder, and prevent its immoderate lateral expansion when subjected to great pressure. When fitted up, the elastic cylinder is compressed between the bars and discs, C D, by screwing up the nuts on the upper ends of the links, B, so that any required initial strength of spring is easily arrived at. Such a bearing-spring is at once light, cheap, and durable, whilst it has a peculiar deadening effect upon concussions, without involving an objectionably long range of elastic action; both the contrivances of an internal helix, and the external binding rings, having an important effect on the working of the cylinder.

Fig. 2 is a similar vertical section, and corresponding horizontal section, of a modification of this kind of bearing-spring, which is, besides, more in keeping, as regards its external appearance and finish, with the *tout ensemble* of a locomotive. In this arrangement, the elastic cylinder, A, is contained in a close chamber, and exerts its springy influence in combination with air and water within it. The bearing-spindle, B, passing up from the axle-box, is entered, at its upper end, into the bottom side of a cast-iron chamber or open-topped box, C, the spindle having a shoulder as a support for the base of the box. The elastic cylinder, A, is entered into this box, and its upper end is covered by a second chamber, D, having two side eyes, E, for passing over the bearing links on the frame. The abutting surfaces of both boxes are grooved concentrically, so that when the cylinder, A, is compressed between them, the elastic material enters into the grooves, and forms fluid-tight joints, for the prevention of the escape of the air and water within the cylinder. The two half-chambers, C D, are so formed as to permit of the vertical play due to the elastic action of the cylinder, which is kept distended by

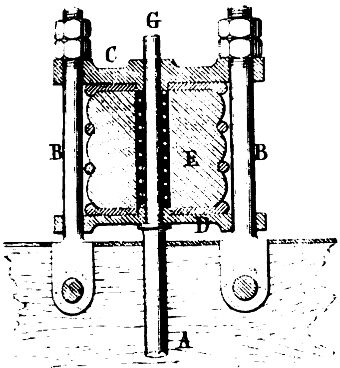
ate 107

RAILWAY SPRINGS &

J.E. COLEMAN ESQ. PATI

LONDON.

Fig. 1.



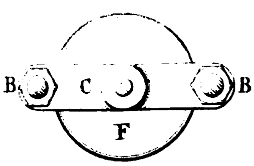
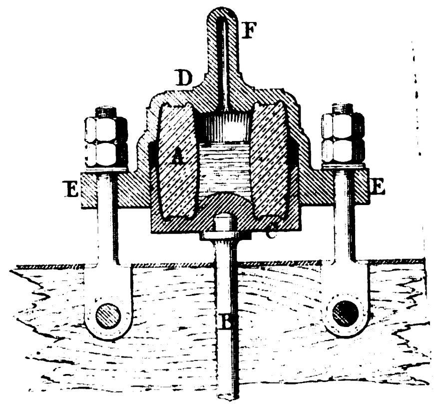


Fig. 2.



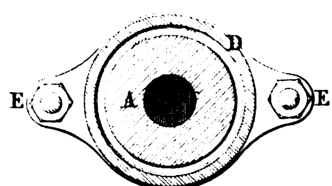
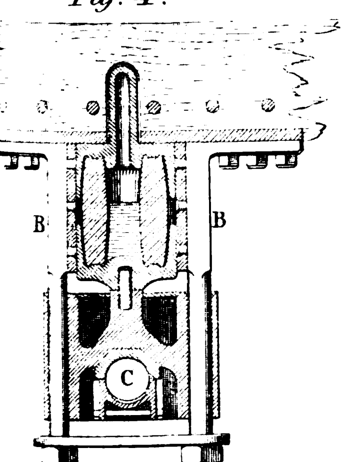


Fig. 4.



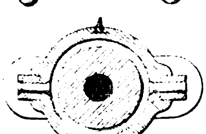


Fig. 5.

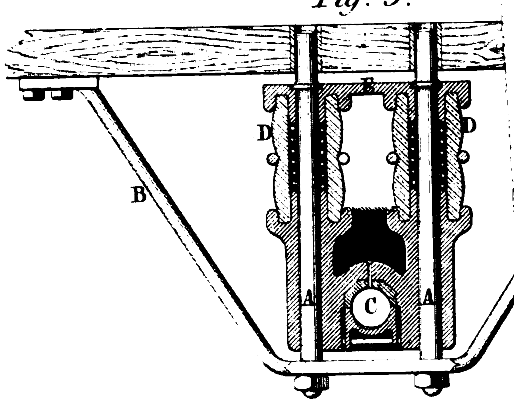


Fig. 7.

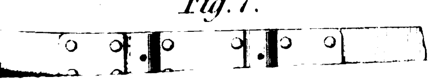
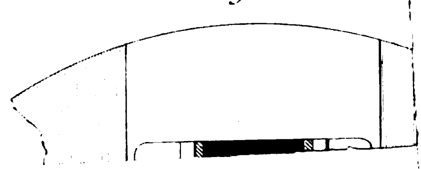


Fig. 8.



the internal resistance of the water. Should any violent compression arise, the upper narrow chamber, F, may receive a portion of the fluid from the cylinder. If the upper chamber is of brass, and neatly shaped and turned, it affords a very ornamental finish to the spring.

Fig. 3 exhibits two similar views of another locomotive bearing-spring, conveniently fitted to the axle-box itself. Here the elastic cylinder, A, is contained, as in the last example, between two cup chambers, and it is distended with fluid in a similar manner; but the bearing-spindle of the axle is dispensed with, the lower chamber being set directly upon the top of the axle-box, B, whilst both chambers are retained, and guided within the cylindrical portion, C, of the wrought-iron main framing. The narrow portion of the upper half of the chamber passes through the top of the frame, and the spring adjustment is effected by the two jam set bolts, D, passing through from the top to press on the upper chamber. This is a most compact spring, and the action is brought close down to the axle bearings, where its effect is essentially needed. The water, too, in the elastic cylinder may serve to keep the bearing cool. The insides of the horn plates, E, are faced with steel plates, to stand the frictional action of the bearing as it works up and down.

Fig. 4 is a modification adapted as a waggon spring, on the same principle as that shown in fig. 3, from which form it differs but slightly. The two chambers containing the elastic cylinder are enclosed within the fixed cylindrical guide, A, rivetted to the upper squared portions of the two vertical rods, B, which answer as horn plates. These rods are bolted firmly up to the under side of the frame by their angular upper ends, and their lower cylindrical extremities are passed through eyes in the axle-box, C, thus serving as vertical guides for the bearing, whilst their extremities are connected by a cross bar, secured with a couple of nuts beneath. This arrangement insures the same compactness as that shown in fig. 3.

Fig. 5 is a vertical section of a carriage or waggon bearing-spring, wherein the spring motion is communicated to the frame through the pair of vertical guide-spindles, A, and the inclined stays, B, which latter are forged in one piece, and bolted, at each end, to the under side of the framing, whilst eyes are formed in the straight horizontal portion for bolting upon the lower ends of the spindles, A. The axle-box, C, is formed with deep guide-eyes to slide upon these spindles, and it has an annular round each eye, on its upper side, to receive the lower ends of the two elastic cylinders, D, which are passed upon the spindles as guides, helical coils being fitted inside them to aid in their free working. The upper ends of the elastic cylinders are similarly received into annular grooves, in the lower side of the upper plate, E, through which the spindles also pass. Each spindle has a slight collar near its upper end, recessed into the upper side of the plate, E, and the ends of both spindles work freely through guide-holes in the frame above, lined with india-rubber. In this example, a single metal ring encircles each elastic cylinder, for the prevention of injurious lateral expansion. This kind of bearing-spring has a light and elegant appearance, and the inclined stays, B, dispense with the necessity of using the ordinary long horizontal stays running between the horn plates.

Fig. 6 exhibits two views of the combined india-rubber and fluid bearing-spring, adapted for a tender. The elastic cylinder, A, with its contained fluid, is held in the cylindrical metal guide, B, which is rivetted, by angle pieces, to the side of the wrought-iron frame. The adjustment of the spring is effected by the screw and nut, C, interposed between the top of the axle-box, and the under side of the lower chamber of the elastic cylinder. The upper chamber abuts against an angle-iron ring, D, rivetted to the interior of the cylindrical guide, B, a ring of india-rubber being placed between this stop and the top of the upper chamber, to do away with any concussion between the metal surfaces. The axle-box, E, slides in the bottom portion of the guide, B.

Fig. 7 is an external side elevation and plan of another modification, suitable both for locomotives and carriages, portions of each figure being in section. The two elastic cylinders, A, are here inserted in a hole cut in the framing, B, each cylinder being encircled by a pair of metal rings, to prevent bulging at the centre. Their spindles are connected at their lower ends to the upper part of the horn plates, whilst their upper ends work through guides rivetted to the side of the frame. The axle's motion is conveyed to the springs by the bottom plate, C, on which the elastic cylinders rest, the lower side of this plate being in connection with the upper side of the axle-bearing. The cylinders are thus quite out of the way, and may be said to fill up merely unoccupied space.

Fig. 8 is the last example which we shall furnish. It is supposed to be arranged for a locomotive crank axle-bearing. The elastic cylinders, A, are placed between the two plates, B, C, the former of which is rivetted to the framing, whilst the latter is connected to the central spindle, D, by its central eye, and an upper and lower nut, the upper end of the spindle, D, being connected to the lower side of the axle-box. The lower plate works upon the two guide-spindles, E, which pass through eyes in that plate through the centre of each elastic cylinder, and are finally fixed at their upper ends in the top plate, B. The elastic action is thus brought into play by the tension of the axle-box spindle, D, pulling up the plate, C, and compressing the two cylinders against the upper plate.

Fig. 9 is a side elevation, and fig. 10 a corresponding longitudinal section, of a railway carriage buffer of the improved kind. The elastic cylinder, A, containing air and water, is placed within the sliding metal cylinder, B, to which the buffer-head, C, is screwed or rivetted. The outer end of the elastic cylinder, A, is sunk into an annular recess in the back of the buffer-head, whilst the opposite end is similarly recessed into the projecting face of the cylindrical casting, D, bolted to the buffer-bar of the carriage. The outer front metal cylinder, B, is fitted to embrace and slide over the end of the fixed shell, D, and it is retained and guided by the two transverse pins, E, which are rivetted at their ends into the cylinder, B, and passed through longitudinal slots in the piece, D. By this disposition, the elastic cylinder is prevented from bulging excessively, by the interior surface of its containing cylinder; and, to prevent injury from any excessive concussion, the inner face of the buffer-head has, in practice, a piece of india-rubber let into a dovetail groove in it; so that, if the head should ever be sent home, this cushion will bear against the convex end of the fixed shell, D. This general plan of securing elasticity is clearly applicable to the various kinds of buffers now in use—the elastic cylinder, for example, being placed beneath the carriage-frame, whilst the buffer-rod projects through the buffer-bar.

Fig. 1, on plate 108, represents a side elevation of a carriage draw-spring, as modified and improved by Mr. Coleman, one portion being in longitudinal section. In this plan, the elastic cylinders are arranged to work in the links of Mr. Booth's well-known right and left screw connection. The elastic cylinders, A, each surrounded by a single central metal ring, are compressed between two end discs, and, in each case, a short metal tube, B, with an end shoulder, is entered through the inner disc into the central bore of the elastic cylinder. The concealed end of this tube has screwed into it the spindle end of the draw-link, C, so that the tensional strain from each link passes directly to the two inner discs, thus compressing the elastic cylinders between the inner and outer discs, the latter being retained by the cross pieces, D, in the two bridles which encircle the whole elastic arrangement. The right and left screw spindle, E, is fitted with a jointed pendulum lever in the usual way, and the screws are entered through nuts, F, formed in the inner ends of the bridles, the screwed ends being allowed to project in to the tubes, B, to afford tightening space. The lever, G, works a jam nut for fixing the screw when once tightened up. The peculiarity of this plan of draw-spring link, in addition to the use of the solid elastic cylinders, consists in the fact, that the elastic action is entirely within the links themselves, the common connecting link being, in fact, thus turned into an effective draw-spring.

Fig. 2 presents an elevation and section of a locomotive tender draw-spring, as fitted with a single elastic cylinder, A, placed between the two end discs, B, C, and confined, laterally, by a single metal ring. The disc, B, is in one piece with the tubular spindle, D, which is passed through the centre of the elastic disc, A, a helical coil of wire being fitted between the tube and the india-rubber. The opposite disc, C, is loose, and is passed upon the other end of the tube, D, and held firmly up against the india-rubber by a cotter, passed transversely through the tube, and through the spindle, E. This spindle passes to the drag-hook of one carriage, whilst the other one, F, the end of which is screwed into the end of the tube, D, is connected to the drag-hook of the other carriage. When the traction strain comes upon this spring, compression of the india-rubber takes place between the two discs, B, C, the tube, D, having liberty to traverse backward and forward upon the rod, E, by means of a longitudinal slot, through which its connecting cotter is passed.

Fig. 3 is a longitudinal section of a similar spring, fitted with an elastic cylinder of increased length, for obtaining a longer spring action.

Fig. 4 represents a side elevation and longitudinal section of the same class of spring, in which the tubular spindle is dispensed with, the traction rods, A, B, being put in connection by means of a bridle, C, which encircles the elastic cylinder. This concludes our selected series of Mr. Coleman's applications of solid india-rubber cylinders, but we could easily increase the number of examples.

Fig. 5 is a transverse section of a double T rail, with its wedge, chair, and sleeper, showing Mr. Coleman's plan of deadening the vibrations of rails during the passage of trains. This is accomplished by merely placing a thin strip of india-rubber in the recess of the chair, as a bed for the rail.

Fig. 6 is a section of another form of rail similarly fitted, a strip of india-rubber being laid over the ridge of a triangular sleeper, upon which elastic surface the angular base of the rail is spiked down.

Fig. 7 is a section of a peculiar form of rail, suitable for street and level crossings, as laid upon two parallel side strips of the elastic material.

Fig. 8 is a side view of a connecting-rod end, with a strip of elastic material, A, B, placed at the back and front ends of the brasses. This is a peculiarly valuable application, as great strain frequently arises from side twists upon the unyielding metal surfaces; but with the india-rubber so placed, even the shocks and jarring, arising from the quick reciprocatory action of the connecting-rod, will be effectually softened.

Fig. 9 is a longitudinal elevation of the guide-bars of a locomotive engine, having a spring-buffer, A, fitted at each end of the guide-bars, to receive the piston-rod slide-block at each end of the stroke. The three views beneath illustrate the details of the spring-buffers on a large scale. For locomotive engines, this application of buffer promises to be particularly valuable, as the crank's action in returning the piston at the termination of each stroke will be materially assisted, just as is done by shutting a cushion of steam in the cylinder.

Fig. 10 is a horizontal section of a railway carriage window, showing the application of a strip of india-rubber to each side, to prevent the unpleasant rattling noise which every railway traveller has felt as a great annoyance. The enlarged section, fig. 11, of the fitting portion of one edge of a window-frame, shows how the material is applied, in the shape of a cylindrical strip, A, laid in the recess of the carriage-frame, for the edge of the window-frame or sash to bear against.

Fig. 12 exhibits the deadening action of an india-rubber strip, in preventing the ringing and harsh jar of anvils, a sheet of the elastic material being laid in the recess of the stock, on which the base of the anvil itself is received.

Fig. 13 is an elevation of a wall-box, containing a pedestal or plummer-block, the brasses of which are similarly shielded with india-rubber above and below, to produce an easy bearing surface; and fig. 14 is a transverse section of a locomotive boiler, the supporting stays of which are bolted down upon the framing, with strips of india-rubber interposed between the surfaces in contact.

All these are sound practical applications of elastic materials, which, as far as they relate to railways, will not only tend to the improvement of dividends, but also add to the comfort of the traveller.

THE "LITTLE ENGLAND" LOCOMOTIVE.

(*Illustrated by Plate* 109.)

The "Little England" is one example of the many practical developments of Mr. Adams' original scheme for running light and frequent trains, with light locomotives.* It is a six-wheel tank engine, and will be recognised in our plate as the engine which, in the Great Exhibition, stood next to Mr. Crampton's South-Eastern engine. It has a pair of driving-wheels, 4 feet 6 inches diameter, with 3 feet leading-wheels, and trailing-wheels of the same size, beneath the tank or miniature tender, which is combined with the engine-frame. Messrs. G. England & Co., of the Hatcham Iron Works, London, have latterly paid a good deal of attention to the construction of this class of engine; and the results which they have secured are shown in the annexed table of some experiments conducted by Mr. Cross, under the instructions of Mr. Adie, on the Edinburgh and Glasgow Railway:—

No. of carriages per Train.	Miles run per day. 47½ m. each way.	No. of stoppages, 3 stoppages each way.	Time of each Trip.	Coke consumed	
				While running.	Including lighting the fire, and standing 4 hours between each Trip.
			Hours.	Lbs. per mile.	Lbs per mile.
7	95	6	1½	8 3	9 7
7	95	6	1½	8 3	9 7
5	95	6	1½	7 4	9 7
4	95	6	1⅓	6 5	8 5

The trains in this case were express, and the trials continued for four days. But on another occasion the little engine took seven carriages full of passengers, and a luggage van, up the incline at Campsie—1 in 85—in very good style. Since the trials here referred to, express trains of five carriages have been taken by the engine on the Edinburgh and Glasgow line, at a cost of no more than 5 lbs. of coke per mile. Indeed, the builders affirm that it is equal to the task of running six first-class carriage trains, at sixty miles an hour. Copies of the "Little England" are also working on the Dundee and Perth, Lancashire and Yorkshire, and London and Blackwall lines; and so confident are the Messrs. England of success, that they have offered to pit their engines against those of any other class, for 1000 guineas, the guage being either broad or narrow, with the load in proportion either to the weight of the rival engines, or the amount of fuel consumed by them.

* See plate 20, Vol. I., P. M. JOURNAL, for drawings of Mr. Adams' locomotive, "Enfield," built for Mr. Samuels, then on the Eastern Counties line.

Such engines as the one which we have engraved, can take a supply of fuel and water for a 50-mile stage—equal to running express trains from London to York with three intermediate stoppages.

PATENT LAW AMENDMENT ACT, 1852.

First set of rules and regulations under the Act 15 & 16 Vict. c. 83., for the passing of letters patent for inventions from and after the 1st day of October next.

By the Right Honourable Edward Burtenshaw Lord St. Leonard's, Lord High Chancellor of Great Britain; the Right Honourable Sir John Romilly, Master of the Rolls; Sir Frederic Thesiger, Her Majesty's Attorney-General; and Sir FitzRoy Kelly, Her Majesty's Solicitor-General—being four of the Commissioners of Patents for Inventions under the said Act.

Whereas a commodious office is forthwith intended to be provided by the Crown as the Great Seal Patent Office; and the Commissioners of Her Majesty's Treasury have, under the powers of the said Act, appointed such office as the office also for the purposes of the said Act.

All petitions for the grant of letters patent, and all declarations and provisional specifications, shall be left at the said Commissioners' office, and shall be respectively written upon sheets of paper of twelve inches in length by eight inches and a half in breadth, leaving a margin of one inch and a half on each side of each page, in order that they may be bound in the books to be kept in the said office.

Every provisional protection of an invention allowed by the Law Officer shall be forthwith advertised in the London Gazette, and the advertisement shall set forth the name and address of the petitioner, the title of his invention, and the date of the application.

Every invention protected by reason of the deposit of a complete specification shall be forthwith advertised in the London Gazette, and the advertisement shall set forth the name and address of the petitioner, the title of the invention, the date of the application, and that a complete specification has been deposited.

Where a petitioner, applying for letters patent after provisional protection, or after deposit of a complete specification, shall give notice in writing at the office of the Commissioners of his intention to proceed with his application for letters patent, the same shall forthwith be advertised in the London Gazette, and the advertisement shall set forth the name and address of the petitioner and the title of his invention; and that any persons having an interest in opposing such application, are to be at liberty to leave particulars in writing of their objections to the said application at the office of the Commissioners, within twenty-one days after the date of the Gazette in which such notice is issued.

The charge for office or other copies of documents in the office of the Commissioners, shall be at the rate of twopence for every ninety words.

PATENT LAW AMENDMENT ACT, 1852,

15 & 16 Vict. c. 83.

By the Right Honourable Edward Burtenshaw Lord St. Leonard's, Lord High Chancellor of Great Britain; and the Right Honourable Sir John Romilly, Master of the Rolls.

Ordered, that there shall be paid to the Law Officers and to their clerks the following fees:—

By the person opposing a grant of letters patent.

To the law officer, - - - - - - - - - - -	£2 12 6
To his clerk, - - - - - - - - - - -	0 12 6
To his clerk for summons, - - - - - - - - -	0 5 0

By the petitioner on the hearing of the case of opposition.

To the law officer, - - - - - - - - - - -	£2 12 6
To his clerk, - - - - - - - - - - -	0 12 6
To his clerk for summons, - - - - - - - - -	0 5 0

By the petitioner for the hearing, previous to the fiat of the law officer allowing a disclaimer or memorandum of alteration in letters patent and specification.

To the law officer, - - - - - - - - - - -	£2 12 6
To his clerk, - - - - - - - - - - -	0 12 6

By the person opposing the allowing of such disclaimer or memorandum of alteration, on the hearing of the case of opposition.

To the law officer, - - - - - - - - - - -	£2 12 6
To his clerk, - - - - - - - - - - -	0 12 6

By the petitioner for the fiat of the law officer allowing a disclaimer or memorandum of alteration in letters patent and specification.

To the law officer, - - - - - - - - - - -	£3 3 0
To his clerk, - - - - - - - - - - -	0 12 6

PATENT LAW AMENDMENT ACT, 1852,

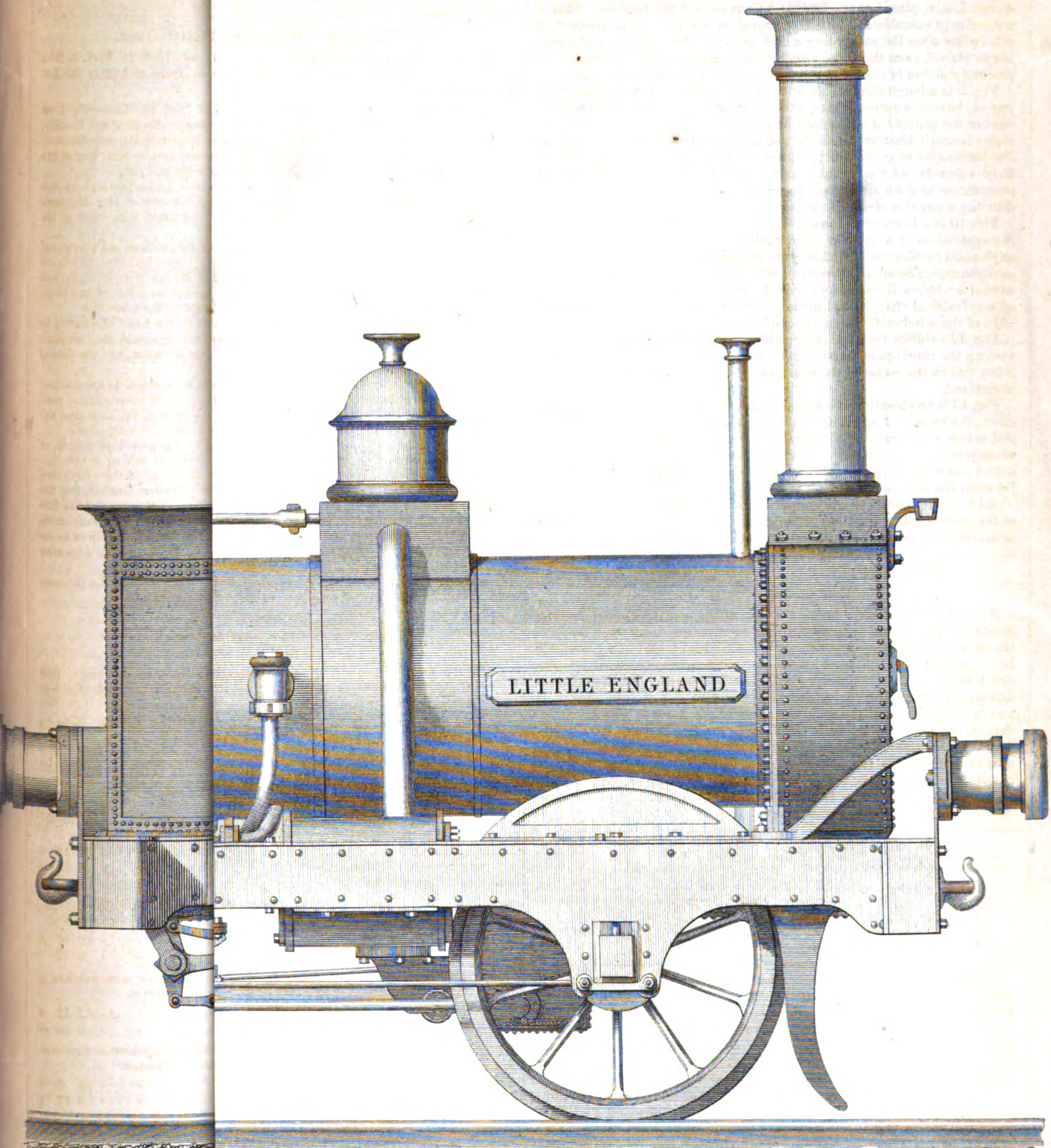
15 & 16 Vict. c. 83.

Ordered by the Right Honourable Edward Burtenshaw Lord St. Leonard's, Lord High Chancellor of Great Britain.

All specifications in pursuance of the conditions of letters patent, and all complete specifications accompanying petitions and declarations before grant of letters patent, shall be filed in the Great Seal Patent Office.

Plate 109

Vol. V.



W. Johnson, Patent Offices,
rdon, Glasgow & Edinburgh.

Engd. by G. Aikman, Edinr.

All such specifications shall be respectively written upon both sides of a sheet or sheets of parchment, each page being of the size of eighteen inches in length by twelve inches in breadth, leaving a margin of one inch and a half on each side of each page, in order that they may be bound in the books to be kept in the said office; but the drawings accompanying such specifications, if any, may be made upon larger sheets of parchment than of the size of eighteen inches by twelve inches, leaving a margin of one and a half inches, as aforesaid.

The charge for office or other copies of documents in the Great Seal Patent Office, shall be at the rate of twopence for every ninety words.

MECHANIC'S LIBRARY.

Cotton Spinner, Practical, 2d edition, 12mo., 3s., cloth. A. Kennedy.
Designs for Gothic Ornaments, 4to., 21s., cloth. J. Gibbs.
Exhibition of All Nations, 1851. Reports of the Juries, 1 vol. 21s., 2 vols. 42s., cloth, gilt.
Gold Seeker's Chemical Guide, 12mo., 1s., sewed. J. Scoffern.
Mathematical Tables, Collection of, 8vo., 6s., cloth. J. Davidson.
Mathematics, Wrigley's Examples, &c., in, 3d edition, 8vo., 8s. 6d., boards.
Metal Work, and its Artistic Design, folio, £6. 6s. M. D. Wyatt.
Mineralogy, new edition, with alterations, by Brooke and Miller, post 8vo., 18s., cloth. W. Phillips.
Mining and Assaying, Gold, foolscap 8vo., 2s. 6d, cloth. J. A. Phillips.
Navigation, Epitome of, 15th edition. By Coleman, 8vo., 16s., boards. Norie.
Plane and Spherical Trigonometry, Elements of, 7s. 6d. Snowball.
Plane Trigonometry, Manual of, 12mo., 2s. Galbraith and Haughton.
Practical Mathematics, Key to, new edition, 8vo., 7s., cloth. Davidson.
Screw-Propeller, Treatise on the, 4to., 38s., cloth. J. Bourne.
Steam Engine, Practical Examinator on, 5s. 6d. W. Templeton.

RECENT PATENTS.

WEAVING CARPETS.

J. H. Johnson, 47 *Lincoln's Inn Fields, London, (Communication.) Enrolled September* 8, 1852.

This is an American invention, presenting some extremely novel and ingenious features in power-loom weaving, as adapted for carpets. The first head refers to a system of working the trap and knot boards of the loom in such a manner, that the second row of heddles, or harness, rises and falls so much farther than the first, and the third more than the second, and so on throughout the entire series of heddles; that, as the warp is sprung, the threads in the same shed, from each row of heddles, whether front, middle, or back, and whether sprung on the top or bottom shed, will all be in the same plane. The second relates to the insertion and withdrawal of the pile-wires or needles, by means of a vibrating quadrant, into which groove the wire is pressed by a roller, as it is inserted and withdrawn. The quadrant moves forward after it inserts a wire, as far as the wire which is to be withdrawn; it then draws the wire, moves back again, and inserts it. According to the third branch, the warp beams are locked and firmly held, just before the lay strikes the cloth, thus holding the warp firmly, to insure the laying of a uniform quantity of weft from end to end of the fabric. The warp beams are released just after the lay leaves the cloth, so that the heddles may spring the warps freely, the locking action again coming into play just before the lay strikes the cloth. The last portion involves a mode of working the picking-sticks with springs, which are pressed out by cams, and released so as to spring suddenly in, to work the sticks and throw the shuttle.

There are a great many novelties in this loom, which are worth the attention of the British manufacturer. Amongst others, the knee-joint and cam action for working the lay, has some advantages which will bear engrafting here.

TREATMENT AND APPLICATION OF SLAG.

Alexander Cuninghame, Esq., *Glasgow.—Enrolled September* 15, 1852.

The "slag," cinder or scoria, flowing from the blast furnaces of the iron-master during the smelting operation, is precisely such an evil as the Tyne collier's ballast. Both are positive nuisances—both are constantly in the way—entailing serious costs in removal and discharge, and, in some instances, even involving the actual purchase of ground to receive the constantly increasing heaps of the useless materials. But Mr. Cuninghame's invention goes at once to the root of the evil, as far as slag is concerned; as he turns the unpromising material into several commercially valuable products, he gets rid of his cinder accumulations, and makes them pay well for removal.

Amongst other matters, he extracts from this refractory bottle-glass-looking stuff, sulphate of alumina and alum. For this purpose the slag is run in its melted state, as it exudes from the furnace, into water tanks, the effect of the water's action being to reduce and disintegrate the material as it cools. By this treatment, the slag, which would otherwise cool and set into hard masses, is cheaply and efficiently reduced to a state suitable for after-treatment of various kinds; but it may also be reduced mechanically by crushing and grinding. When thus granulated, the slag becomes light and friable, and in this condition it is treated with sulphuric acid, and the sulphate of alumina is afterwards dissolved out of the mass with the aid of water, and separated by decantation or filtration from the sulphate of lime and silica, the pure solid sulphate of alumina being obtained by evaporation. If alum itself is to be made, then potash or ammoniacal salts are added to the sulphate of alumina, the alum of commerce being obtained by crystallization. The residuum of hydrate of silica and gypsum is a valuable soil-fertilizer; or these matters may be ignited in contact with aqueous vapour, and the sulphurous acid thus driven off is available for the production of sulphuric acid in the usual way, whilst the residuary silica and lime may be employed in the manufacture of mortar and cement, or for general plastic purposes. By a distinct process, the patentee obtains alumina, silica, and chloride of calcium from the slag. The reduced slag is, in this case, treated with muriatic acid, and the resultant solution of chloride of aluminum, and chloride of calcium, is separated by filtration or decantation, leaving hydrate of silica undissolved. From this solution the earth alumina is obtained, either by precipitation with milk of lime or ammonia; or, by evaporation to dryness, igniting the residuum, and dissolving out the chlorides of calcium and magnesium with water. The chloride of calcium is got at by evaporating the solution, as obtained by either of the modes of producing alumina already described. The prepared slag is also applicable for the purification of pyroligneous acid, instead of lime, as used at present; and it may also be used for the decomposition of certain salts, muriatic acid and alkali being obtainable from the muriates of potash and soda, by heating in a retort in contact with aqueous vapour. Mr. Cuninghame thus finds, in his slag hills at Glengarnock and Carnbroe, something more than a mere annoyance, for the various chemical matters which he now obtains from them are of great value in many arts—the fertilizing products are well suited for many of the purposes of the farmer, and the compounds for plastic purposes are useful as well in ceramic manufactures, as in the production of the highest class of mortars and cements.

MANUFACTURE OF ROSIN OIL.

Hermann Turck, *London.—Enrolled August* 14, 1852.

Aided by this invention, Mr. Turck is enabled to produce, from the same quantity of rosin, three different commodities—acid, naphtha, and oil—distinct and separate from each other. This is done by the following very simple process.

A still is filled to about two-thirds its contents with rosin, amongst which, by means of a pipe fitted with a perforated coil near the bottom of the still, a jet of steam is introduced at or before the time of lighting the fire. As in the first stage of heating, the rosin is very apt to boil over, the still must be disconnected from the condenser to avoid the injury and explosion that might ensue, were the boiling rosin to enter the condenser. The heat must be gradually increased till it reaches 325° Fah., when acid will be discharged, and the temperature must not be kept stationary till the acid ceases to flow.

During the whole of the distillation, steam is injected by the pipe above mentioned; it passes through the rosin, and carries off the naphtha with it in the form of vapour. The quantity of naphtha so produced is about 15 per cent. of the bulk of the rosin under treatment.

The acid and naphtha being run off, the temperature is raised to 550° Fah., and oil passes off as vapour, and is condensed, being in quantity about 25 per cent. of the rosin. When the oil ceases to flow, the temperature is raised to 600° Fah., when more oil will be produced to the extent of about 12½ per cent. of the rosin; after this, the fire may be extinguished. The residuum left in the still resembles pitch, and may be put to similar uses; it is run off by a duct at the bottom of the still.

The oil is partially purified as it passes off, by the injection of steam by means of a pipe entering the still near the top, and fitted with a rose.

The patentee next proceeds to describe his processes for purifying the oil, and qualifying it for lubricating purposes. The oil produced at a temperature of 550° Fah. is re-distilled, being first mixed with 5 per cent. of slacked lime. The heat is gradually raised to 550° Fah.; but steam is injected by both of the pipes already mentioned, when it is at about 300°, and by this means the oil is bleached and purified. It is, however, again passed through this process, caustic being substituted for the slacked lime. The oil is then placed in a bleaching kettle, or pan of any convenient form, and heated to 225° Fah., by a steam-pipe entering and coiled in the lower part of the kettle. Steam is also injected through another pipe and rose till the oil is fused, when the colouring matter

produced in it by the atmosphere will be expelled, and the oil will be ready for use.

The oil originally produced at a temperature of 600° Fah., is treated in the same way as that produced at 550°, except that at 300° steam is injected only by the lower of the two steam-pipes—it being injected by the other at 600°. The oil produced in this case is called by the patentee, "currier's or tanner's oil."

A still finer oil for painters is obtained from oil originally produced at 650°—the same being treated as in the last process—the steam being injected by the upper pipe, only when the heat reaches 650°. This oil is afterwards boiled, and suitably prepared for admixture with pigments.

WEAVING AND PRINTING CARPETS AND SHAWLS.

JAMES MELVILLE, *Roebank Works, Renfrewshire.—Enrolled Sept.* 29, 1852.

The essential peculiarity of the first head of this invention, is the weaving a duplex fabric, or, in other words, two foundations or backs of fabrics, connected together by a long pile of the material, forming the face of the pieces—the pile being afterwards severed transversely, to form two distinct pieces of pile fabrics—without the use of intermediate slips or needles for raising and adjusting the pile. This important system of weaving is as simple as it is ingenious. Instead of weaving both backs, so that each shot of weft in the upper and lower backs is thrown at the same time, in the same vertical line, the lower back is always kept several shots ahead of the upper one; that is to say, the woven portion of the lower back always extends several shots further forward on the reed side than the upper one. Then, during the process of weaving, the angular distance between the two sheds of the upper and lower backs, regulates the length of the intervening pile of wool. This system is carried out by adding to the ordinary reed a species of secondary reed, carried by the slay in front of the usual reed. The latter acts only on the lower shed, whilst the secondary reed, the dents of which project down from the lower edge of their frame-bar, is similarly confined to the upper shed, and each shot of weft in the upper shed is held until secured by the succeeding one, by a row of hooks on a holding-frame passing across the piece.

Another portion of the improvements embodies a system of printing shawls and other goods, by stretching the fabric on an impression cylinder of large diameter, such cylinder being arranged to work in concert with a printing roller, on which the "repeat" of the pattern is engraved. In printing a border by this plan, the two opposite parallel edges of the piece are stretched on the large cylinder in a line with the cylinder ends, and the colour apparatus being set on a rail in front of the cylinder, the two borders are printed in succession; and the printing apparatus being then detached, is removed to another cylinder, to make way for the succeeding colour on the first. The printing roller is so contrived as to be capable of the most accurate adjustment to the impression cylinder on each change, so as to keep perfect register; and the attendants are thus enabled to print all the colours in a series of pieces by continually running through a series of impression cylinders, with the corresponding colour rollers, one after the other. By another modification, Mr. Melville also prints shawls and other fabrics stretched upon a square table, hung vertically, the printing roller revolving in fixed bearings, whilst the table traverses in contact with it. But the most curious process is that in which the pattern is engraved upon a conical printing roller, and the fabric is stretched on a square table, revolving on a vertical plane. If a shawl corner is to be printed, the pattern is so placed on the roller that the angle shall be on the widest end of the cone, a diagonal line drawn through the centre of the corner coinciding with the axial line of the cone. Then, as the shawl revolves on its table, the impression is successively laid on, so that the corner device shall exactly fill up the corners of the fabric.

Another peculiar plan consists in stretching some classes of square fabrics upon a round table, when wet, so that the square temporarily assumes a circular form. In this state it is printed by a conical roller, and a peculiar distorted effect is obtained by reason of the corners of the piece being very little stretched, whilst the parallel sides, which have undergone excessive stretching, will shrink to their original state in drying, thus contracting the impression at those parts. We are, of course, enabled to give but a mere outline of these valuable improvements here.

REVIEWS OF NEW BOOKS.

CIVIL ENGINEERING AND MACHINERY GENERALLY. By Henry Hensman, Esq. Bogue: London. Pp. 18.

The ages of the world are not to be reckoned by years. That is a truth becoming dimly appreciable in these its elder days. A patient review of all history tells very significantly how very *little* periods of time have to do with mundane affairs—even the greatest. Statists may present the means for the discovery of very many importants laws regulating the social community—laws against which it is somewhat unwise to exclaim; but the dynamist is yet to be born, almost yet to be thought of, who may be able to point to those hours on the dial of the past, when mankind was awaiting the striking of the time which ushered in a new state of things. If we look around, we reflect, in common-place thought, upon the darkness and mystery covering the origin of most of the creatures we behold. It is the same as regards that which those creatures themselves perform. For him who first observed the simplest action of gravity, to make bold and announce himself as the discoverer of the law of gravitation, might merely be absurd. And yet, if we could retrace, object by object, and thought by thought, the course which Newton's mind had passed—from the trembling moment when he demonstrated his theory, back to the period when he first observed anything, or appropriated the observations of others, it is not so out-of-the-way a possibility, that we might scarcely be able to say when the real thing first impressed itself upon man's mind, and began to regulate his aspirations or his efforts. Notwithstanding this, it is undeniable that certain "times" do present to observation certain peculiarities—it may be of greatness, it may be of littleness—but certain peculiarities which are felt very seriously to have affected humanity indeed. And it is among the singular facts which reflection furnishes, that every people, in every age of the world, has deemed itself the most knowing—the most important; just as if all preceding time had been but a pupilage to the sheer business of life, which the hour for the time being present had commenced, with a vigorous and hearty good-will, to act upon.

It has been thus with many things, and it *is* so with "civil engineering and machinery generally." We may look around, but we really cannot tell where we are, whence we have come, and whither we are tending. This is an age of refinement, we are told. Why, every age is an age of refinement beyond all ages that have been. Deny not this by pointing to any early "more glorious" age, unless, at the same time, you bring all its accessories to boot, and then put them all into one scale, and the poor, unfortunate, and depreciated present—whenever you may fancy it to be—into the other. It ever has been really, and it ever will be, because it *must* be, that "all the past glories" will kick the beam. It seems to be a fact, that certain things shall arrive at certain times at high, haply very highest, excellence—excellence that shall be excellence for long lines of centuries; and, as far as they are concerned, the "present" may have somewhat—perhaps all—to look back upon to learn; but taken as one whole, with all its other excellences, with whatever other defects, "the present" is the greatest and best result, as (seen in its universality) it must inspire the highest and best assured hope regarding the future.

The few pages which are here before us, suggest, rather than exhibit, the light in which approaching times may look back upon ourselves as its instructors in the mightiest efforts of human skill—skill, be it always remembered, inseparably connected with human enjoyment, and as shown in the great departments of industry which the author (who was the manager of the Machinery department, and, with his son, a prize-medallist) touches upon. He quickly runs the gauntlet of the three "Classes:" V. Machines for direct use; VI. Manufacturing machines; and VII. Civil engineering and architecture—the latter two subjects taking up three pages! All criticism thereon must of course be withheld. He mentions, and barely mentions, as it was only necessary and natural to mention, some of the objects challenging principal attention. Our readers will well remember one of the prettiest movements in the Machinery department. Mr. Hensman notices it as follows:—

"Amongst the steam-engines was one sent by Mr. Davies of Tipton, to which was attached a most beautifully arranged governor. It consisted of a single hollow ball, with a zone round it, with an opening through the bottom to admit of an upright spindle, which was attached to the ball by a joint in its centre. One side of the ball and zone was made much heavier than the other, and consequently, when at rest or moving slowly, it hung down, but when driven fast, the centrifugal force of the heavy side overcame its gravity, and the zone assumed nearly an horizontal position. When this was the case, a small link inside the ball, jointed on one side of the axis, lowered the usual brass collar on the spindle, and shut off part of the steam, till the speed, diminishing, allowed the gravity of the zone to overcome the centrifugal force, and the link being raised, the throttle-valve was opened wider to admit more steam."

Centrifugal pumps, again, are a distinguishing suggestion of what future times may see. As it is (and such things "were little known, and scarcely ever used, before the time of opening the Exhibition") we have learned the valuable lesson, that "great effects may be produced by a small noiseless machine, running at a high speed, in place of the old-fashioned cumbrous pumps, making a few strokes per minute, and shaking the very earth near them at each stroke."

"In the class of land steam-engines, the Exhibition did not fairly represent the state of things in the world generally." The reasons com-

bining to produce this result may be found in the bulky and heavy nature of the objects themselves, and in the necessary limit of six-horse power having been fixed for engines that were put in motion.

It is not possible that we can long rest without some very great and important discoveries in relation to water-travelling. The screw-propeller is yet, as Mr. Go-a-head is constantly remarking of other matters, but "in its infancy." What will be its power when it has grown even to a mere hobbledehoy, no one can yet say or even (judging from the past) imagine. The "simplification of parts" is now, we are told by Mr. Hensman, "very much studied," and this is the rudiment of the language in which every future story of progress is to be told.

Another fact the natives are beginning to hear in another form, as quietly, perhaps, and as pleasantly, as two or three lines may be read after a siesta; but the great different result following! This fact is embodied in these words—"Printing presses and machines shown by English exhibitors were numerous and good; but few, if any, were on the foreign side!"

But "the greatest triumph of the Exhibition was," says Mr. Hensman, catching at a pointed thought, "the building itself." If, however, its triumph rested there, it would moulder away as rapidly, we opine, as does the goodness which is not experienced beyond the individual. He tells us, in a better strain, that "the object of these lectures is not so much a description of what was" at the Exhibition, "as of the probable influence that it will have upon the future state of things." Mr. Hensman reckons among such coming results in his department, our new acquaintance with reaping machines, the certainty of the uncertainty in the security of our locks, the unpleasant dawning of consciousness of the ill construction of the hulls and sails of our vessels, and the superiority we are compelled to acknowledge of the steel rollers of our Prussian friends.

The author justly remarks, that the state of the patent laws has attracted more attention in consequence of the Exhibition than it would otherwise have done, and the Act of last session is not among the least important of the many law reforms then effected.

The opportunity afforded to the general spectator, of studying in the Exhibition an immense number of complex operations, "was one that the world had never previously known, and the crowded state of the building in that part testified the interest it excited." The truth is, that (from the cradle to the grave) man is an active animal. The child's toy and the old man's machine, with which each is most delighted, shares with all surrounding things, in greater degree, activities and motions of their own. It is this that makes "the play" so favourite a pastime; and the exciting novel, lazily perused on a drawing-room sofa, is but as an index to activity and motion still. Right heartily glad are we that this is so; for it indicates a something of the true, into which we are now beginning to lead our youngsters. May they prosper, say we, to their hearts' content, and ever have about them such men as the present author, who has set us on so pleasant a vein of thought for the last few minutes.

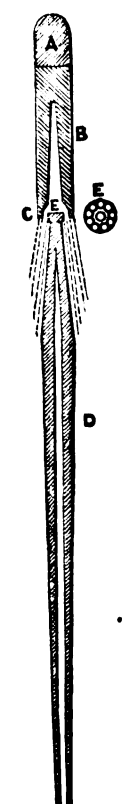
Projectile Weapons of War, and Explosive Compounds. By John Scoffern, M.B. London: Cooke & Whitley. 1852. 2d Edition. Pp. 213.

The more terrible we render the chances of war, so much the nearer do we approach the extinction of this dreadful scourge of nations; for, in the words of Dr. Scoffern, "so soon as certain death awaits two rival armies, princes must fight their own battles, or war must cease." Hence we may reasonably presume, that the late "wars and rumours of wars," and the discussions upon ball-sights and systems of rifling, may not be without their use in practically promoting the brotherhood of nations, and in the more accurate direction of mankind towards their "path, motive, guide, original, and end." The first edition of Dr. Scoffern's little work was published so long ago as 1845; his preface informing us, that "immediately on being announced for publication, the whole stock, with the exception of about a dozen copies, was purchased by the agent of a foreign state, and exported, so that it never found its way into British literary commerce." This mysterious announcement arouses our curiosity to know what "foreign state" was so excessively attracted by the merits of Dr. Scoffern's labours as to buy up the entire edition, No. I.; and secondly, how it came to pass, seeing so ready a sale was thus met with, that the second edition did not make its appearance for seven years. But be this as it may, our immediate business is with the book as it is, and we are glad to be able to say, that it is a satisfactory performance. It seems to be an upright critic and a faithful guide. It is pleasing to contemplate the quiet stealthy growth of an art; and although the subject of the present volume carries with it much that is painful, yet the philosopher may find some pleasure in tracing the gradations of improvement in arms—beginning with throwing sticks and stones, and ending with the needle-gun, the revolver, and the heavy ordnance of the nineteenth century. Dr. Scoffern affords a pleasant means of accomplishing this, for he amuses us with the grotesque fallacies and hollow labours of the ancient chemists and alchemists, and the traditions of ages past, whilst he instructs us in those accessories of modern science which teach us how to "kill our foes according to the most approved laws of mathematics and chemistry."

Explosive compounds have always been favourite subjects of research with inquiring chemists, but in Spain, at least, the refinements of science have hardly yet been felt in the manufacturing of gunpowder.

"In Spain, the public gunpowder manufacture is a government monopoly, and the article is both dear and bad. Hence the peasants have long been stimulated into the preparation of their own. The operation is carried on with great secrecy, just as illicit distillation in the wilds of Ireland and Scotland, and subject to frequent interruption; yet the result is by no means despicable, as I have often proved. The chief defect of this powder is softness of grain, but it ignites with great facility, and fires with sufficient rapidity in a percussion gun to answer all common purposes. Having secured the confidence of a gentleman of uncertain profession, who spent a great deal of his time amongst the mountain passes leading from Salobrena and Almunecar to Granada, armed with a blunderbuss for defence, it is supposed, the writer of these pages was favoured with a private inspection of the domestic powder manufacture. A mortar was employed for braying the three components together, moistened with water, and the half dry paste was grained by pressure through a sieve; no preliminary compression having been employed, and hence the softness of grain."

The author contradicts the story of Berthollet's artificial preparation of nitre:—



"The process was known to, and described by the chemist Glauber. In Prussia and in Sweden, the making of nitre has been cultivated as a piece of state policy. The king of Prussia obliged his farmers to build their fences of nitre-forming materials, which, after a few years, were taken down and appropriated. In Sweden, so careful is the government on this point, that each farmer is obliged annually to furnish a certain quantity, which must be paid in kind—government will not compound for it—thinking that by following such a course it guards against the injurious consequences which might arise during a war, if the supply of nitre were drawn exclusively from abroad."

A very important chapter of this volume is that on "war rockets," in the construction of which, the British are unrivalled. Every one has remarked the common sky rocket, but the war missile may bear some explanation.

The part, A, indicates the piece of iron attached to the rocket, and serving as a shot—it might have been a shell, a carcass, &c. B corresponds with the body of the rocket, filled with composition, and perforated as in a common rocket; the base of this conical opening expands, it will be observed, into a chamber, F, which is absolutely necessary in order to prevent the rocket bursting; although this necessity adds greatly to the mechanical difficulties which must be encountered. C represents a sectional view of a piece of gun-metal, a front view of which is shown by E. In this consists the great peculiarity of the congreve rocket, enabling the stick, or rather the iron with which it is shod, to be screwed into the central opening, whilst the smaller peripheral offices communicating with the hollow cone, of which the section of two only are seen in the diagram of the rocket, serve as vents to the flame, and correspond with the one central opening in the common sky rocket."

This was the great invention of Congreve, the stick being replaced by an iron tube—the annular explosive discharge allowing of the central attachment of the tube—as an accurate guide. Mr. Hale has since added many improvements to Congreve.

The Prussian needle-gun—already so fully discussed by us—of course receives some notice, and a fair share of praise at Dr. Scoffern's hand, and so also does Col. Colt's revolver, which the author considers to be far superior to its English rival. But we have, perhaps, already furnished a sufficient index of the nature and value of the volume, which has well deserved its second edition.

Amusements in Colour. By H. Grant, Esq. London: Waterlow and Sons. A Table of Elementary Practical Geometry; A Table of Architecture.

These three productions do not fall strictly within the range of the reviewer of new books, for the first is not a book; the second is only on its way from the desk of the author to the press of the printer, and thence to the eye of the public; whilst the third has but enjoyed a "private circulation." But there are more reasons than one why we should thus treat Mr. Grant's efforts. All who have given any attention

to such matters must have been struck with the great general ignorance on the subject of colour, which prevails amongst the masses of the people. In this respect, even our manufacturers—but especially the operative producers—suffer deplorably in comparison with the same classes in France, and some other parts of the Continent, and, indeed, of the East. Millions may be said to be annually lost to us from this cause; for, as before alluded to in an article, "Colour Printing," of last month, a French paper-hanger, with the same colour, paper, and amount of labour, produces much more in the market than ours, because the French workman has a feeling for colour.

An elementary knowledge of the principles and harmonious arrangements of colour is easily acquired. For instance, Mr. Grant, who, we may add, is a highly philanthropic gentleman, residing at Fairseat, Wrotham, Kent, gave twelve experimental lessons to a class of little girls of ages varying from 8 to 12 years, and his report is, that "they took great pleasure in the subject, comprehended it readily, and would not, I think, be guilty of the discordant arrangements so often seen in our coloured goods."

Acting on the practical hints thus gathered, Mr. Grant drew up an elementary table on the subject, and a sheet now lying before us is one of a few copies which he has himself lithographed in blank, for the children to paint in as a lesson and memento. This very clear chart gives, first, the composition of colours—the primary colours being followed by the secondary and tertiary, showing their relative proportions; —second, the arrangement of colours, subdivided into their contrasts, harmonies, and discords; and these are followed by light and shade, light and darkness, warmth and coldness, and brilliancy. These divisions, appropriately coloured in sections, are calculated to appeal at once to the child's perceptions, suitable directions being printed on the sheet. In his lessons the subject was in addition illustrated by coloured cards, patterns in silk and cotton, as well as flowers and paper-hangings.

The "Amusements in Colour,"—forming what the author modestly calls "a very humble and elementary beginning,"—are in the shape of a neat little pasteboard box, filled with right-angle triangles of coloured cardboard, and accompanied by two sheets of coloured diagrams, with a set uncoloured, but marked to guide the experimentalist in making the endless combinations of which the triangles are capable. We may be excused for calling special attention to the publication of this box, by Messrs. Waterlow of London Wall, for it seems certain that a knowledge of its existence would lead to a revision of our existing instructions in colour—if, indeed, it can be said that children of any grade are instructed in colour at all. The idea is, at any rate, worth testing in the common schools of the manufacturing districts. A dozen lessons a-year would involve but a small sacrifice of time, and would very soon alter the feeling of the operative classes.

The "Table of Elementary Practical Geometry" has been drawn up for the use of young workmen, and the boys in ordinary schools, who do not learn theoretical geometry. This has not been published, as it is the intention of the author to issue a tract on the subject, the table being an abridgment of such tract, which he has lithographed for preliminary dissemination amongst practical men, in order to ascertain the species of arrangement and details most suitable for artisans. This sheet is very full, and seems to be well arranged as to its diagrams and explanatory matter, to answer as a workshop companion. But we should be glad to aid the author's views, as to obtaining suggestions from the workshop itself.

The "Table of Architecture" is a very large sheet of artistically sketched examples of the erections of all nations, from the rude mound and cromlech to the cathedral and the palace, illustrated by brief notes and definitions of the leading characteristics of the several styles. Like the preceding chart, this might fittingly occupy a place on the shelves of the study, or the walls of the workshop, furnishing a ready means of verifying a style, or aiding the conception of a detail.

The elevated feeling which has induced Mr. Grant to take upon himself, not only the conception, but the actual multiplication and working out of these educational schemes, commands our highest praises, and deserves our best wishes, for he has laboured truly and zealously, as well to enunciate the truths of science as to disseminate the deductions of practical experience.

Dynamics, Construction of Machinery, Equilibrium of Structures, and the Strength of Materials. By G. Finden Warr. Pp. 296. Woodcuts. London: Baldwin. 1851.

The general arrangement, typography, and even the woodcuts, at once indicate Mr. Warr's book to be what its title-page further tells us, "a continuation of the treatises on mechanics in the 'Library of Useful Knowledge,'" for it has about it all the dry solidity of its dreary-looking predecessors. According to its preface, the author's object is "to supply that which was wanting in the former part of the 'Library of Useful Knowledge' on mechanical science. In three treatises Dr. Lardner has taken up the subjects of the mechanical agents, or first movers; the elements of machinery (statics); friction, and the rigidity of cordage. In the present are considered the principles of moving forces, or dynamics, the equilibrium of artificial structures, and the strength of materials used in the arts: the first is theoretical, and the latter three treatises are occupied with the most important matters of practical mechanics." A very short examination of the matter thus promised, suffices, in our estimation, to show that Mr. Warr has not escaped that very common result of a too great condensation of a too large subject—superficiality. For example, his selection of matter for the article "pendulum" in his first section, carries us back to very ancient authorities, several of the more important modern contrivances, such as Loseby's spring compensation, being utterly overlooked. Again, in his second division, "construction of machinery," we have all the old square-toothed gearing of the past century, with the "trundles," "lanterns," and "wallowers" which now figure only in ancient mechanical history, and, as it turns out, in the note-book of Mr. Warr, we have to protest in the strongest terms against this resuscitation of barbaric crudities, for which the merest engineering apprentice would at once condemn the volume. His strictures on the "stepped" spur-wheel, the invention of which he attributes to Dr. Hooke, are also open to the criticism of the practical man, for they savour more of what this contrivance was a century ago, than what modern practice has made it. Besides this, who that writes on mechanical matters in the nineteenth century, would go into a disquisition on that obsolete antique, the "cross-tailed gudgeon" and its kindred absurdities, as given at page 57? But we ought to condemn the scheme of the volume, rather than its consummation; the system which the author has pursued, rather than his short-comings in bodying it forth on paper. Of the more useful chapters, that on dynamometers claims some notice, for it furnishes a good deal of information within very narrow limits. But we next stumble upon 112 pages devoted to the "equilibrium of structures," very fairly done, it is true, but not exactly in place amongst so many practical subjects, elbowing one another in a mere nook of 300 pages. The rest of the volume is taken up by the "strength of materials," which has been very carefully written. But the time has now gone by for books of this stamp. The "Library of Useful Knowledge" was collated for other days than ours, wherein a division of reading, and a discriminative compilation of matter, is as necessary as the modern practice of the division of industrial operations. In some sections, Mr. Warr has given evidence of some laborious theoretical research, but he has also left us in others to lament the absence of practical detail—as the *Rambler* wrote just one hundred and one years ago, "frighting us with rugged science, or amusing us with empty sound."

Remarks on the Combination of Timber and Iron Framings in the Building of Ships, recently constructed by Messrs. L. Arman & Co., of Bordeaux. London: Bradbury and Evans. 1852. Pp. 14. Plate.

We have to refer our readers to our September number* for a description of the invention, in explanation and support of which the pamphlet before us is written. The full account we there gave, leaves us very little to add on the present occasion. After noticing the defects attending ships constructed entirely of wood or iron, the author goes on to claim for his combination of the two systems, freedom from the defects of either, added to the advantages belonging to both.

This new system was first put in practice in the building of the steamer, *General Castilla*, the weight of whose hull is only 160 tons, or 35 per cent. of her displacement, which is 460 tons. The success attending this trial has led to the construction of other and larger vessels, one of which is 2,400 tons burthen; also, to the experimental adoption of the system by the French government, in the building of the corvette *La Mégère*.

The strength of the *General Castilla*, or *Cazador*, as she was afterwards named, was put to as severe a test as is ever likely to be met with. When full laden, and ready to start for her destination, the Southern Seas, she ran aground in the river at Bordeaux; she broke from her moorings, and was driven by the violence of the wind on the top of the stone quay, where, during a whole tide, she remained suspended by her stern, besides having attached to her stern the strongest lighters in the river, to prevent her filling with the returning tide; so that she was entirely supported by her extreme ends. She underwent all this without the least change of form, though 160 feet long, and carrying amidships an engine of 120 horse power, and 200 tons of coals.

* Page 135.

We cannot better conclude this short notice, than by giving an extract from the report of Mr. Assier, read before the Chamber of Commerce of Bordeaux, in reference to the establishment of a line of steamers between Bordeaux and Chagres. After explaining the system of Messrs. Arman, he adds:—

"We might have been charged with boldness in venturing to recommend the adoption—for so important an operation as that we are now studying—of a mere theory, however able its inventor might be; but fortunately, gentlemen, Mr. Arman's plan has already been brought into practice. The *Messager* is the second steamer built according to this new system. The first has already arrived in the Southern Seas, and the trials she has successfully underwent proved the superiority of the plan. The *Cazador*, as she is now called, struck upon the rocks, and was floated without the least appearance of any leakage. M. Montané, on whose account this steamer had been built, felt so satisfied with the results, that, without hesitation, he ordered a considerably larger vessel to be constructed on the same plan. The French navy will be much indebted to him for having risked a large capital in undertakings that might not have been successful.

"The transatlantic steamers will therefore be constructed with timber and iron framings. They will be lighter, and consequently, having the same capacity and the same power, their speed will be superior to timber-built vessels."

Mechanical Inventions and Suggestions on Land and Water Locomotion, Tooth Machinery, and various other Branches of Theoretical and Practical Mechanics. By Lewis Gompertz, Esq. London: Horsell. 1851. Pp. 75. Woodcuts.

The future D'Israeli of science, who shall one day write the "curiosities of mechanism," may draw largely upon Mr. Gompertz, who has condensed not a few ingenious eccentricities into this little volume. As a reprint from the pages of many periodicals, where our readers must have often crossed the author's name, we are relieved from the labour which would otherwise be required for the dissection of the heterogeneous mixture of subjects before us. Indeed, it would be a hopeless task to attempt the particularization of the many suggestions which Mr. Gompertz has given to the world throughout the last half century. The repetition of many of them would be a twice-told tale; but there are others which may yet afford novel hints for the consideration of the practical mechanic.

CORRESPONDENCE.

ON THE PROPULSION OF VESSELS BY THE SCREW.

I find your Journal for September contains a review of my treatise on the Propulsion of Vessels by the Screw, upon which, will you kindly permit me to make a few observations.

You seem to think (I judge from your remarks) that the title to my work is not well chosen. It appeared to me, on the contrary, that it would allow me to say as much or as little as the object I had in view might seem to warrant. If I have succeeded in explaining the mode in which the screw-propeller acts, and how its action is influenced by the ship and the engine with which it is connected, I trust that those who may wish to avail themselves of the information will not blame me for compressing the matter into a "nutshell;" and if I am wrong in my conclusions, even the little I have said must be superfluous. Besides, I felt the less hesitation in abstaining from writing volumes, as that task had already been accomplished by Mr. Bourne.

I was perhaps wrong in promising an explanation of the quantity Δ, as it is a co-efficient like many others, which present themselves in cases of this kind. At the foot of the table containing the results of a number of experiments with government screw-steamers, I stated that this co-efficient depended no doubt upon the number of the blades and the angle of incidence; an opinion which I have since found to be correct. Your idea respecting the yielding of the water can scarcely hold good. The water yields certainly; it does so in the case of a ship, or any other body passing through it, but it only yields after having offered a certain resistance, depending upon the velocity and shape of the moving body. Why a screw blade should form an exception to the rule, I cannot see.

I take it for granted, that when a new ship is being built with the intention of letting her be propelled by steam-power exclusively, she is fitted with the most powerful engines which she can contain, consistently with her contemplated immersion. Unless I am mistaken, my formulæ do not exclude any kind of engine; and no doubt you will agree with me when I say, that if we could succeed in obtaining 100 horse-power with the same weight of materials and fuel which we now require for 50, we should be all the more successful in the propulsion of vessels. This object, however, cannot be attained without an increase of velocity, which means a reduction in the size and weight of the propeller. It is, therefore, my humble opinion, that, independently of other considerations, we should first do our best for the engine, and then try to find the most suitable propeller for it. To construct the most efficient screw-propeller for a given ship, without knowing at what velocity the engine will drive it, is, in fact, an impossibility. To produce a desired effect, the velocity is quite as essential as the dimensions of the screw, as it is evident that, for instance, a screw, with an effective surface of four feet, develops as much resistance when revolving at the rate of fifty feet per second, as an effective surface of eight feet produces at a velocity of thirty-five feet. The question of the most favourable angle of incidence, can be equally well decided in small screws as in large ones.

As the effective pitch of a screw is only slightly affected by the velocity of the engine and the ship, it certainly would be possible to determine beforehand, with sufficient accuracy, the dimensions of the propeller, so as to produce any desired effective pitch; but this would be of little avail. We should next want to know what effect such a screw would produce upon the ship; a question which could not be answered without the velocity of the screw being given. But the velocity of the screw evidently depends upon the evaporation, which is the moving force; the evaporation again depends upon the construction and dimensions of the boilers and engine; and these dimensions are limited by the immersion of the ship—which brings us back to the point whence we started. Admitting, however, for the moment, that the plan you propose could be carried out, how many engineers do you think would be found willing to alter their engines for the sake of the screw?

I quite concur with you in the opinion, that the best screw-propeller would be one in which the blades could be set to any required angle, so as to enable the engine to work at the most favourable velocity under all circumstances; and it appears to me that Mr. Woodcroft's plan fulfils these conditions.

R. Bodmer.

London, September, 1852.

[Mr. Bodmer reviews our review of his book pretty nearly to the extent which we allotted to ourselves, without passing further than the brink of the subjects at issue between us. We have reason emphatically to say, that no author is to be condemned for giving his views in the fewest possible words. Were that practice more general, we should be enormous gainers, for we count no time so irredeemably and so unworthily lost as that which, as journalists, we consume in the dissection of ill-digested and prolix contributions; nor do we arrogate a right to dictate a title for an author's book; but we do consider it not more our right than our duty to venture an opinion in a case like the present, where a very wide and comprehensive text is taken for a very narrow strip of discourse. What we said, however, was nothing more than a stricture on the author's apparent view of the extreme compressibility of the subject.

We merely offered the passing suggestion as to the "yielding of the water," and Mr. Bodmer's remarks give us no reason to alter our views on this point; but a discussion upon it here, would carry us far beyond the space at our disposal.

On the more important point—of proportioning the engines to suit the screw, instead of adapting the screw to the engines—Mr. Bodmer has barely understood us. By all means let us take advantage of all the power practically obtainable from any given source; but it certainly does not follow, that we are restricted to a given system of applying this power to the propeller. This may be effected by a variety of modes, and we take it to be clear enough, that, with a given power, a given propeller will produce the best result, when that power is transmitted at a velocity bearing some determined proportion to such propeller. If, for a variety of engines developing the same amount of power, but invested in different velocities, we construct propellers according to Mr. Bodmer's rule, or so as to be most efficient for each particular engine, will identical results be secured in each combination? We think not. If the propeller is to be proportioned to the engine, the performance ought to be the same throughout the series; but we have little hesitation in asserting that one particular combination would be found to excel the rest. To determine the best combination engages many minds at the present moment, but every new screw-steamer tells us that it is a problem yet to be solved. In ships already afloat, the engineer would certainly adopt the lesser evil of altering his propeller, rather than meddle with his engine. But how is this to instruct the builders of new ships, or what part does it play in that current of improvement which guides us towards the original production of the best screw vessels, whether as regards hull, engines, or propellers?

Mr. Woodcroft's propeller is an effort in the path which we have indicated, but we doubt if his arrangement is free from "counteracting accompaniments."—Ed. *P. M. Journal.*]

METALLIC AND WOODEN SAILS FOR SHIPS.

I perceive, in Part 53 of the *Practical Mechanic's Journal* for August, 1852, an interesting paper by J. P. Joule, Esq., on the construction of tubular iron masts for sailing vessels. The material and mode of construction recommended by Mr. Joule seem to be well adapted to their purpose, but I believe that practical experience will tell us that no actual strength of material will afford a self-supporting power to a mast, so as to stand well without the aid of shrouds, and mainly by reason of the enormous leverage with which the wind acts on the mast, in comparison with the resistance which it opposes at its foot. The use of shrouds, however, does not preclude the introduction of iron masts. But I offer another suggestion. I propose to make some, or all of the sails, of wood or sheet copper, either plain or corrugated. The description of the modes of folding and unfolding such sails would be an endless task, as they are innumerable. By suitable gearing, plates, suspended on pivots, horizontally or vertically, may be contrived to expose either their edges or faces to the wind, at any required angle. They may be jointed to each other, and rolled up like the fire-proof shutters of our modern shops. They may also be worked on the principle of the familiar "lazy tongs," or caused to expand and collapse like fans. Like the sails of a windmill, they might be made self-acting; but in all cases of their adaptation, the ease and rapidity with which they might be removed from the wind's action, would enable the mariner to avail himself of an increasing gale, if at all favourable, for a much longer time than at present. It is possible that, with iron yards constructed on Mr. Joule's principle, as described by him for masts, a much greater breadth of sail, if wood or metal, may be used on masts, half, or less, the height of those now in use; an object, if attainable, of immense importance, seeing that the effective stress upon a mast increases in a rapid ratio with its height.

W. K. Westly.

Leeds, September, 1852.

GLASS SAFETY LAMPS—BOW BREAST DRILLS—BACKING CARTS.

Seeing that the common Davy lamp is objectionable on many well-known points, I should be glad to know why common glass lamps cannot be used. It appears to me that there is no solid objection on the score of brittleness; therefore, why not adopt them?

Passing to another subject, I have to offer a suggestion for the improvement of the common breast drill, so as to cause it to drill truly. We can pretty easily ascertain the horizontal direction of penetration of a drill, but it is a different matter in drilling vertically. To afford a better guide to the eye, I employ a long straight rod, in which the drill is held, and this rod has a long recess in it, to hold a small loose ring of metal. Thus, in drilling horizontally, if the point of the drill is too much downwards, the ring will traverse towards the point, and, if too far up, the ring will go the contrary way.

I have also a third suggestion, as to attaching the front horse to wheeled carriages, so that it may assist the hind or shaft horse in backing. My plan is, to connect the front horse to the back shafts by a pole or stiff shaft with a swivel, so that it may be free to turn, and yet give the front horse the means of pressing backwards. But the joint must not be on the side of the back shaft; therefore, the latter must be so made that it can be jointed to the centre. This would be a great relief to the hind horse, whilst it would prevent the front one from being trampled on in case of falling.

L. Gompertz.

London, September, 1852.

[Glass lamps, fitted with wire gauze, are already in use. See Mr. Crane's lamp, p. 150, vol. i., P. M. Journal.—Ed. *P. M. Journal*.]

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

MEETING OF THE BRITISH ASSOCIATION AT BELFAST.

September 1st.

Colonel Edward Sabine, R.A., President.

The report of the Council, and the general Treasurer's account were read. From the former it appeared, that the following gentlemen had accepted office for the year:—

Section A.—President, William Thomson, Esq., Mathematical Professor, Glasgow; Vice-President, Right Rev. Dr. Denvir; Secretary, W. J. M. Rankine, Esq.

Section B.—President, Dr. Andrews, M.R.I.A.; Secretaries, Robert Hunt, Esq., Dr. Hodges, Dr. Blyth.

Section C.—President, Lieut.-Col. Portlock, R.E.; Secretaries, James M'Adam, Esq., J. Bryce, Esq., Prof. Nicol, Prof. M'Coy.

Section D.—President, William Ogilby, Esq.; Secretaries, Dr. Lankester, J. C. Hyndman, Esq., Dr. Dickie.

Section E.—President, Col. Chesney, R.A.; Secretaries, R. Cull, Esq., Dr. Norton Shaw, R. M'Adam.

Section F.—President, the Archbishop of Dublin; Vice-President, V. Whitla, Esq.; Secretaries, Prof. Hancock, J. M'Adam, Esq., jun.

Section G.—President, James Walker, Esq., F.R.S.; Vice-President, C. Lanyon, Esq., C.E.; Secretaries, Charles Manby, Esq., C.E., James Thomson, Esq., C.E.

The Council have added the names of the following cultivators of science to the list of corresponding members of the British Association:—M. Babinet, Paris; Mr. P. G. Bond, Cambridge, U.S.; M. Dufrenoy, Paris; M. Constant Prevost, Paris; M. Pierre Tchihatchef, Paris; Dr. N. Nordenskiold, Finland; Prof. Asa Gray, U.S.

Invitations for future meetings had been received from Hull, Liverpool, Brighton, Glasgow, and Leeds.

From the Treasurer's account we find that £1,690. 17s. 6d. had been received, and £1,452. 7s. 7d. expended, leaving a balance of £237. 9s. 11d. in favour of the Association.

ABSTRACT OF THE PRESIDENT'S ADDRESS.

The Mathematical and Physical Theories of *Light* have afforded subjects for many interesting and profitable discussions in Section A, and have usually had one day in the six specially allotted to them. Those discussions will derive a more than usual interest at this meeting, from the remarkable discovery recently made by Prof. Stokes, that under certain circumstances a change is effected in the refrangibility of light,—and from the advantage we possess in having amongst us, on this occasion, the eminent mathematician and physicist by whom this most important contribution to the science of physical optics has been made. His researches took their origin from an unexplained phenomenon discovered by Sir John Herschel, and communicated by him to the Royal Society in 1845. A solution of sulphate of quinine, examined by transmitted light, and held between the eye and the light, or between the eye and a white object, appears almost as transparent and colourless as water; but when viewed in certain aspects, and under certain incidences of light, exhibits an extremely vivid and beautiful celestial blue colour. This colour was shown by Sir John Herschel to result from the action of the strata which the light first penetrates on entering the liquid; and the dispersion of light producing it was named by him epipolic dispersion, from the circumstance that it takes place near the surface by which the light enters. A beam of light having passed through the solution, was, to all appearance, the same as before its entrance; nevertheless, it was found to have undergone some mysterious modification, for an epipolized beam of light—meaning thereby a beam which had once been transmitted through a quiniferous solution, and had experienced its dispersive action—is incapable of further epipolic dispersion. In speculating on the possible nature of epipolized light, Prof. Stokes was led to conclude, that it could only be light which had been deprived of certain invisible rays, which, in the process of dispersion, had changed their refrangibility, and had thereby become visible. The truth of this supposition, novel and surprising as it at first appeared, has been confirmed by a series of simple and perfectly decisive experiments; showing that it is in fact the chemical rays of the spectrum, more refrangible than the violet, and invisible in themselves, which produce the blue superficial light in the quiniferous solution. Prof. Stokes has traced this principle through a great range of analogous phenomena, including those noticed by Sir David Brewster in his papers on "Internal Dispersion;" and has distinguished between "cases of false internal dispersion" or "opalescence," in which the luminous rays are simply reflected from fine particles held in mechanical solution in the medium, and those of "true internal dispersion," or "fluorescence," as it is termed by Prof. Stokes. By suitable methods of observation, the change of refrangibility was detected, as produced not only by transparent fluids and solids, but also by opaque substances; and the class of media exhibiting "fluorescence" was found to be very large, consisting chiefly of organic substances, but comprehending, though more rarely, some mineral bodies. The direct application of the fact, as we now understand it, to many highly interesting and important purposes, is obvious almost on the first announcement. The facility with which the highly refrangible invisible rays of the spectrum may be rendered visible, by being passed through a solution of sulphate of quinine, or other sensitive medium, affords peculiar advantages for the study of those rays; the fixed lines of the invisible part of the solar spectrum may now be exhibited to our view at pleasure. The constancy with which a particular mode of changing the refrangibility of light attaches to a particular substance, exhibiting itself independently of the admixture of other substances, supplies a new method of analysis for organic compounds, which may prove valuable in organic chemistry.

Among the subjects of chemical inquiry which may well deserve the attention of a combination of philosophers, perhaps few could more usefully occupy their joint labours than the revision of the Equivalent Numbers of the Elementary Bodies. This is a task which must necessarily require the co-operation of several properly qualified individuals, if it be accomplished within anything like a reasonable period of time. Most of the numbers now in use depend upon experiments performed by Berzelius, at a time when the methods of research then known were inadequate, even in such hands, to determine these constants with an accuracy sufficient for the wants of science at the present day. So much has this been felt to be the case, that many of the most accomplished chemists now living have undertaken extensive and laborious, though isolated researches upon the combining quantities of

some of the most important elements. But much more than has been already performed still remains undone.

The Theory of Heat has made great advances within the last ten years. Mr. Joule has, by his experiments, confirmed and illustrated the views demonstrated about the end of the last century by Davy and Rumford regarding the nature of heat, which are now beginning to find general acceptance. He has determined with much accuracy the numerical relation between quantities of heat and of mechanical work. He has pointed out the true principles upon which the mechanical value of any chemical change is to be estimated, and by very careful experiments he has arrived at numerical expressions for the mechanical equivalents in some of the most important cases of chemical action, in galvanic batteries and in combustion. These researches appear to be laying the groundwork for the ultimate formation of a *Mechanical Theory of Chemistry*, by ascertaining experimentally the mechanical equivalents, expressed in absolute motive force, of the thermic, electric, and magnetic forces. Mathematical developments of the theories of heat and electro-dynamics, in accordance with these principles, are given in various papers by MM. Helmholz, Rankine, Clausius, and Thomson, published principally within the last two years. In discussing these subjects, the Section will have a great advantage in being presided over by the last-named of these gentlemen, a native of Belfast, who, at so early an age, has attained so high a reputation, and who is taking a leading part in the investigations to which I have referred.

In connection with the subject of heat, I would advert to the experiments in which Mr. Hopkins is engaged, for investigating the possible influence of high pressure on the temperature at which substances in a state of fusion solidify—an inquiry which was shown by Mr. Hopkins, in a report recently presented to the British Association, to have an important bearing on the questions of the original and present state of the interior of the earth. It is well known that the temperature of the earth increases as we descend, and it has been calculated, that, at the rate at which the increase takes place in such depths as are accessible to us, the heat at the depth of 80 or 100 miles would be such as to fuse most of the materials which form the solid crust of the globe. On the hypothesis of original fluidity, and assuming that the rate of increase known to us by observation continues farther down, and is not counterbalanced by a considerable increase in the temperature of fusion, occasioned by pressure, the present state of the earth would be that of a solid crust of 80 or 100 miles in thickness, enveloping a fluid nucleus. Mr. Hopkins considers this state to be inconsistent with the observed amount of the precession of the equinoxes, and infers, that if the temperature of fusion be not increased considerably by pressure, the hypothesis of internal high temperature being due to primitive heat cannot be correct; whilst, on the other hand, if the temperature of fusion be considerably heightened by pressure, he considers the conclusion unavoidable, that the earth must be solid at the centre.

Mr. Hopkins is assisted in these experiments, which are carried on at Manchester, by the well-known engineering knowledge of Mr. Fairbairn, and the equally well-known experimental skill of Mr. Joule. The principal difficulties attending the experiments with substances of low temperatures of fusion have been overcome, and strong hopes are entertained of success with substances of more difficult fusibility. The pressures employed are from three to four tons to eight and ten tons on the square inch. The latter is probably equal to the pressure at several miles beneath the earth's surface.

The success which the Kew Observatory Committee have had in their undertaking to make Standard Thermometers, encourages us to hope that they will be equally successful in the endeavour in which they are now engaged, to introduce a greater degree of precision in the construction of meteorological instruments generally, as well as in the more delicate kinds which are so frequently required in physical experiments. An establishment has long been a desideratum in which instruments for various physical researches employed in foreign countries, should be tried in comparison with the instruments used here, and the relative merits of each examined; and in which new and promising inventions and suggestions should receive a practical trial. Amongst its other services rendered to science and to the country, the British Association is now entitled to claim the merit of having organized an establishment which appears extremely well suited to supply this deficiency, and needs only more extensive means to supply it to any required extent. The applications which have been made in Kew in the past year, by Profs. Forbes and Thomson, for thermometers of particular kinds, required in very delicate experiments in which those gentlemen are engaged, and by the Admiralty for standard thermometers for very low temperatures, to be employed by the Arctic expeditions, show that the advantages to be derived from such an establishment are already beginning to be recognised; and as these become more known and felt, it may confidently be anticipated that means will not be wanting for such an extension of the establishment at Kew as may be necessary to meet fully the public requirements. The desire which is so frequently manifested by voyagers and travellers in distant countries, to contribute to our knowledge of terrestrial physics, would be greatly aided by increased facilities afforded to them of obtaining suitable and well-assured instruments, and still more if practical instruction or advice could be added. It is not from deficiency of interest, or of a desire to be useful in such inquiries, that our British travellers do not reap the full advantages of the great opportunities which they possess, so much as from the absence of any provision for supplying instruments on which reliance can be placed, with practical instructions for their use. In no department is the "systematic direction," which it is the object of the British Association to communicate to the sciences generally, more needed than in physical geography. To carry this desirable purpose into effect, might, with great propriety and public benefit, be made to form a branch of the duties of the Kew Observatory.

The opportunity which the Kew Observatory furnishes to the members of the Association, of a convenient locality, presenting many facilities for carrying on a series of delicate experiments, has been taken advantage of by Prof. Stokes, for experiments in which he is engaged on the *Index of Friction in different Gases*. Experiments reported by myself to the Royal Society in 1829, showed that the retardation of a pendulum vibrating in different gases was not proportionate to their respective densities, but appeared to depend also on some inherent quality, whereby the different gases present different degrees of resistance to the motion of bodies passing through them. I was interrupted in the prosecution of this subject by a recall to military duty, and I now rejoice to see it in hands so far more able to do it justice.

The parliamentary committee appointed at the Ipswich meeting, to watch over the interests of science, consisting of members of the British Association who are also members of the Legislature, have this morning made their first report to the general committee; and some notice of the subjects which have chiefly occupied them in the past year, may not be unacceptable to the members of the Association at large. One of these subjects is that of scientific pensions. It is known to all, that since the commencement of the reign of her present Majesty, pensions to the amount of £1,200 have been at the disposal of the first minister of the Crown, to be granted each year, in recompense of civil services, chiefly, though not exclusively, in literature and science,—and that several persons, of various degrees of literary and scientific eminence, have received pensions accordingly, many of which have given much public satisfaction. On examining the appropriations which have been made in the fourteen years since this fund became available, it appeared that only about 13 per cent., or an eighth part of the whole amount, had been allotted to *scientific* pensions. Considering this to be a proper subject to be brought under the notice of Government, Lord Wrottesley, the chairman, and Sir R. H. Inglis, one of the members of the committee, obtained an interview with the Earl of Derby for that purpose. The readiness of Government to attend to such representations, has been fully shown in the scientific pensions granted in the present year, amounting to nearly a third of the whole sum available for the year. These pensions have been granted, on the recommendation of the President of the Royal Society, to Mr. Hind, who has the unique distinction of being the discoverer of no less than six out of the twenty-five known planets of the solar system; to Dr. Mantell, so well known for his successful researches in palæontology; and to Mr. Ronalds, for the electrical and kindred researches in which he has been engaged for so many years. The intimate association of the scientific services of Mr. Ronalds for several years past with the Observatory of the British Association at Kew, must render this last selection peculiary gratifying to our members.

Thursday.

Section G.—Mechanical Science.

"Report on the Tensile Strength of Unwrought-Iron Plates, at various Temperatures," by Mr. Fairbairn.

"Report on the Mechanical Properties of Metals, as derived from repeated Meltings, exhibiting the maximum Point of Strength, and the Causes of Deterioration," by Mr. Fairbairn.

"On the Form of Iron for Malleable Iron Beams or Girders," by Mr. T. M. Gladstone.—It is, said Mr. Gladstone, on the application of wrought-iron beams or girders I propose to make some remarks, by contrasting their powers and properties with those of cast-iron; to show what form of iron I conceive best adapted for such use, and to state, as a manufacturer, what may be expected as the capabilities of iron-works to produce the same beyond previous efforts, so as to meet the increased requirements of the times. It is found that, by converting iron from a cast into a malleable state, the adhesion of the fibres of the metal, under tension, becomes increased from 7 to 27, and indeed much beyond that when the best quality of material is manufactured. At the same time, it is stated that the compressive strength is somewhat reduced. In this latter assumption I do not altogether concur, from a permanent feature in the experiments not being sufficiently taken into account—namely, that in experimenting with wrought-iron, at a given extension from pressure, it is necessary, before you obtain even a medium value of the resistance, a modicum of deflection must take place to bring into play each of the fibres; consequently, not like as in a rigid cast beam, where the full action of compression acts at once, some allowance must be made for the change from the first position, in calculating the compressive forces. Assuming, generally, that the increased strength of tensive power of wrought compared with cast-iron is 27 to 7, it at once reduces the sixfold area of the bottom web of the iron beam, and nearly reduces to one-half the required sectional area throughout, yet retaining an equal strength for every purpose. In many cases, this increase of strength, enabling to to reduce the weight, will fully compensate for the difference in price, so that up to this point the market and effective value of both may be said to be equal. The wrought-iron beam, however, possesses this material advantage, and that is, it will always give good warning before the point of danger is reached, and this, mainly, from its vastly increased deflective power—indeed, before its maximum is reached, a great deflection can safely take place; therefore, both for life and property, its advantage is most conspicuous. With regard to the best form for carrying the greatest weights with the least metal, I have come to the conclusion, from actual experiment on a large scale, that the double T section is the best, provided the flanges are sufficient to prevent lateral action from the load. At the Belfast Iron Works, the members can see iron of the section shown in bars of twenty-six feet long, and weighing nearly half a ton; so that it will be seen the mills are now constructed so as to roll iron almost any dimensions which may be required, and such bars, from the breadth of the flanges, have never before been attempted in the three kingdoms. When I had the honour, some four years ago, to read a paper at the Society of Arts, on a means of constructing bridges without any centering of

such proportions of iron, no ironmaker would attempt to produce such a proportion of material, while now I have accomplished it, and would have no hesitation in making them much larger if required. I have not a doubt, for warehouses, mills, public buildings, and bridges, its value will now become extensively applied and appreciated. As these bars are rolled solid throughout, on comparison I have found they will bear nearly one-third more than any made beams of equal sectional area—that is, with a beam of which the centre rib is of plate-iron, and the flanges of angle-iron, and riveted thereto, and so distributed as to make the double T form. This is easily accounted for, as you necessarily weaken the whole by its being requisite to introduce riveting, while a due and equal resistance is offered from all parts by the solidly rolled bar.

"An Account of a New Flax-Dressing Machine, invented by Matthew Whyttla, Esq., Auckland, New Zealand."

"Design for Safety Harbours," by Mr. J. Saunders.

"On the Evolution of Gas in Wallsend Colliery," by Professor Phillips.—This is one of the numerous coal mines in Yorkshire, which have been rendered remarkable for the frequent explosion of the inflammable and noxious gas with which they are filled, and the loss of life which has in so many cases been the consequence. In every coal-pit there are two shafts, one of which serves to admit the pure air, whilst the foul gases are made to escape by the other. The ascent of the foul gases is frequently facilitated, by creating a draft by fires placed near the bottom of one of the shafts. The coal is arranged in perpendicular layers, between which the gases exist in a highly compressed state. In order to detach these layers with the least possible danger, it is usual to cut through them endways, by which means the gases are allowed to make their escape at once from a considerable portion of the coal. A district of this colliery, covering about fifty acres, was effectually walled up, in consequence of the immense discharge of gas that was continually taking place. A pipe was led from this enclosed portion up through the mine, and for forty feet above the surface, and from this pipe there has been a constant discharge of gas for the last eighteen years. This gas has been inflamed, and in the roughest and most stormy weather it has burned without intermission; and were it as rich in naphtha as ordinary carburetted hydrogen, it would illuminate the country for miles round. Two water-pressure guages were fixed to the brick walls, one at the surface of the earth, and the other at the bottom of the mine, and the results were, that whilst the pressure in the mine was only 9-10ths of an inch on an average, that at the top of the pit was upwards of four inches. From observation in these mines, it is seen that discharges of fire-damp, governed by atmospheric pressure, take place before being indicated by the barometer, and that, as an indicator, that instrument cannot be relied on. A fact somewhat similar was first observed by Professor Daniels, in his researches at the Royal Society, where the water barometer indicated the change of pressure an hour earlier than the usual mercurial standard barometers constantly used for observations.

Friday.

"On the New Patent Law," by Mr. T. Webster.

"On Telegraphic Communication between Great Britain and Ireland, by the Mull of Cantyre," by Mr. J. M. Rankine and Mr. J. Thomson.—The advantages are as follow:—It is the shortest line across the channel, being only thirteen miles from Tor Point to the Mull of Cantyre, while the distance from Donaghadee to Portpatrick is twenty-two miles. It is the safest line; for no vessel can anchor across it. It has the local advantage of connecting the North of Ireland directly with the ports on the Clyde.

"On Telegraphic Communications by Land and Sea," by F. C. Bakewell.

"On Telegraphic Time Signals," by Mr. C. V. Walker.—The object was, to explain the arrangements that have been completed, as far as his part in them extends, for promoting the scheme of transmitting Greenwich mean time throughout the kingdom. On the 5th of August, the first time signal passed; and, on August 19th, the clock at Greenwich, which originates the signals, having been brought to time, and the adjustment elsewhere having been completed, the regular transmission of signals commenced—in the first instance, to Dover, at noon, and at 4 P.M. Mr. Walker then described the apparatus constructed by Mr. Shepherd, and erected at the London terminus, by which the connections are made. And incidental to this, it is to be understood that in the galvanic room at the Royal Observatory, is a set of ordinary sand-acid batteries (to be replaced ultimately by graphite batteries); one battery termination is connected with the earth by means of the gas-pipes, and the other with a spring contained in Mr. Shepherd's electro-magnetic clock. The Greenwich London wire also terminates in the same clock; and the connections are such that, at the last second of the last minute of each hour, this line-wire and the battery-wire are placed in contact for an instant; and consequently, if the circuit is completed at the other end of the wire, whether at London, Dover, Rochester, the Strand, Lothbury, or elsewhere, a signal will pass every hour; and, when the circuit is left open, no signal will pass. To accomplish this, a train of wheels is connected with the rod of Mr. Carter's large turret-clock, now erected over the South-Eastern terminus. Sets of springs are placed near at hand to some of the wheels; the springs are all tipped with platinum, and are respectively connected with the several wires concerned in the scheme; and, according as the contacts between the several springs are varied, so is the time-signal led to its destination. Mr. Walker then explained an ingenious contrivance, by which, at the completion of the circuit at Greenwich, a voltaic current of instantaneous duration passes from Greenwich to Dover, and causes one sharp deflection of the galvanometer needle of the usual electric telegraph. The clerks at the several stations, should they overlook the general order to cease working, and to be on the watch, are reminded that the time is nearly due by finding that the telegraph circuit is broken; which happens during the two minutes that the spring is lifted by the pin off the earth wire at London. The clerks watch the signal, and make note o the error of their local clock. The time-signals will, at set times, be allowed to pass automatically to Hastings, to Deal, and to Ramsgate, by turning them on the main line by the usual telegraph turn-plates now in use at junction stations. The signal will be transmitted to intermediate stations by hand, which can be done correctly to a fraction of a second. The clerk will watch for the signal while he holds in his hand the handle of a group, or a branch instrument; he will move his hand as he sees the signal, and a simultaneous signal will pass along the group.

"On Graphite Batteries," by Mr. C. V. Walker.—After referring to the unfitness of copper, and the too great cost of the superior metals for the purpose of batteries, Mr. Walker said he had early sought a substitute for both purposes, and had found one which seemed to promise all that was required in the deposit of carbon from gas, or graphite.

"On Strains on Lattice-Girders," by Mr. J. Barton.

INSTITUTION OF MECHANICAL ENGINEERS.

June 29, 1852.

J. E. M'Connell, Esq., V.P., in the Chair.

This was a special general meeting at the Society of Arts, the proceedings being opened by a paper, "On the Mathematical Principles involved in the Centrifugal Pump,"—by Mr. A. J. Robertson.

After some discussion, which the chairman very properly wound up, by stating that in all experiments on questions involving the expenditure of power, no dependence could be placed on anything not backed by actual dynamometrical results. A paper "On the Expansive Working of Steam in Locomotive Engines," by Mr. D. K. Clark, was read. This was a continuation of a paper on the same subject, read at the last meeting.

"On the Expansion of Isolated Steam, and the Total Heat of Steam," by Mr. C. W. Siemens. The extensive experiments of the talented author of this paper are of the highest importance. The object of the present statement was, first, to lay before the meeting a set of results corroborative of Regnault's disproval of Watt's law, "that the sum of latent and sensible heat in steam of various pressures is the same; secondly, to prove the rate of expansion, by heat, of isolated steam; and, lastly, to illustrate the immediate results of these experiments in the expansive working of steam." We shall return to this paper on a more fitting opportunity, when we can devote the space due to its value.

"On Bourdon's Metallic Barometer, Indicator, and other applications of the same principle." We have already discussed Mr. Bourdon's ingenious instruments under more than one form.* Our last number furnishes additional particulars of some of the other curious modifications of the contrivance.

July 28th, 1852

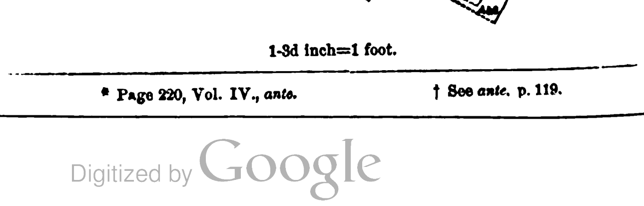
Joseph Whitworth, Esq., in the Chair.

The discussion on Mr. Robertson's paper, "On the Mathematical Principles involved in the Centrifugal Pump," opened the business of the evening. This was followed by a paper, "On a new improved Screw-Propeller," by Mr. G. H. Bovill, London. This was explained to be the propeller recently invented by Mr. Griffiths, having a large spherical boss, and blades narrowing towards their peripheries. "On a new Direct-acting Steam-Pump," by Mr. W. K. Whytehead, London. "On improved Fire-brick Gas-Retorts," by Mr. J. E. Clift, Birmingham. After the meeting, Mr. M'Connell exhibited a model of his recently invented and ingenious system of Permanent Way.

MONTHLY NOTES.

Government Trials of Anchors at Sheerness.†—We now give the continuation of these valuable experiments, including the last two days' trial on dry land, with illustrative sketches of the nine different anchors under test. We have also added a diagram and table of the previous experiments made at Woolwich, and the transverse sections of the shanks and arms of the series.

Diagram showing the comparative lengths of the shanks and arms, and the angles described by straight lines drawn from the extreme points to the centres of the crowns.



1-3d inch=1 foot.

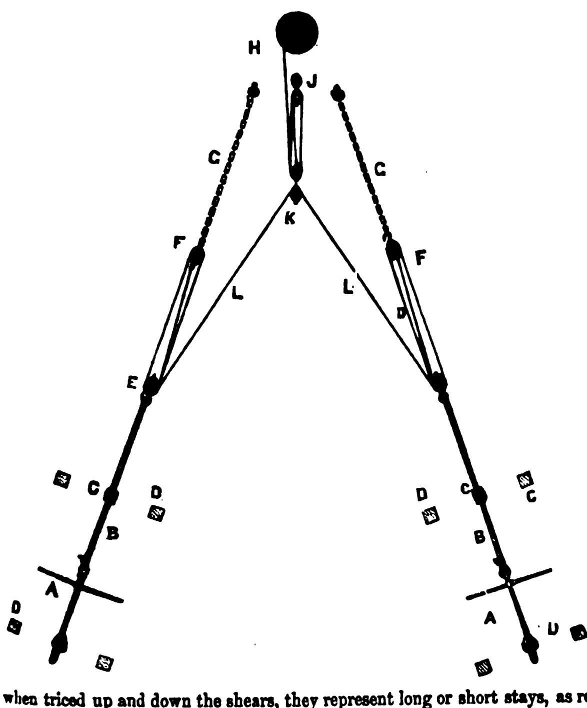
* Page 220, Vol. IV., *ante*.

† See *ante*. p. 119.

TABULATED RESULTS OF WOOLWICH TESTS.

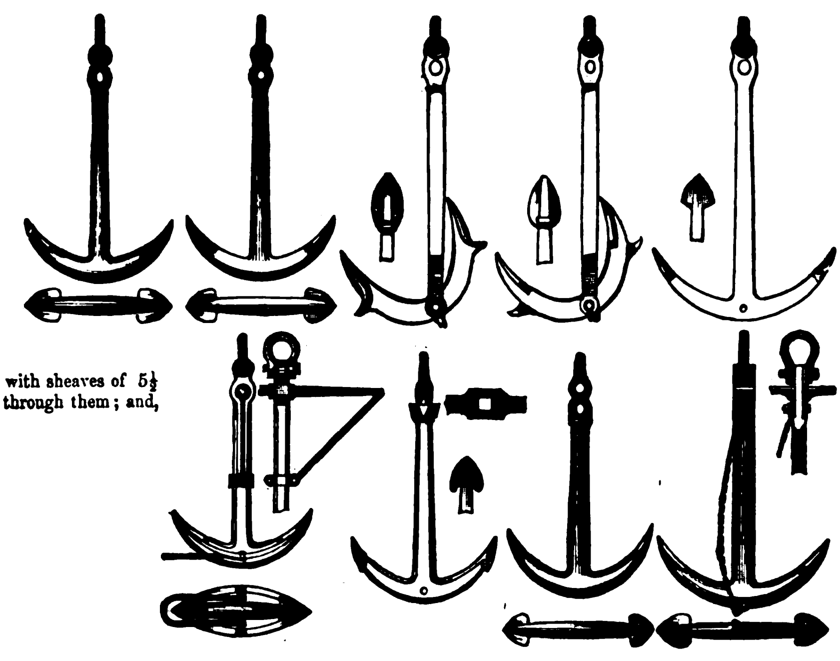
Proprietors.	Weight of Anchor.			Weight of Stock.			Total Weight.			Proof.	Deflection. 1st Arm.	Deflection. 2d Arm.	Permanent Set. 1st Arm.	Permanent Set. 2d Arm.	Length of Rod.		Manufacturers.
	Cwts.	qrs.	lbs.	Cwts.	qrs.	lbs.	Cwts.	qrs.	lbs.	Tons.					Feet.	Inches.	
Rodgers, ...	19	0	8	5	2	14	24	2	22	$19\frac{7}{8}$	Full. $\frac{5}{16} \times \frac{1}{8}$	$\frac{5}{16} \times \frac{1}{8}$	0	$\frac{1}{16}$	5	$8\frac{1}{8}$	Fox, Henderson, & Co.
Mitcheson, ...	21	0	0	4	0	14	25	0	14	$21\frac{5}{8}$	Full. $\frac{11}{16} \times \frac{1}{8}$	$\frac{11}{16} \times \frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	6	$0\frac{7}{16}$	Holsgrove.
Brown, sen., ...	20	3	14	3	2	24	24	2	10	$21\frac{1}{2}$	Bare. $\frac{4}{8} \times \frac{1}{8}$	$\frac{3}{8} \times \frac{1}{8}$	0	0	5	$2\frac{1}{2}$	Brown, Lennox, & Co.
Isaacs, ...	21	0	14	4	0	3	25	0	17	$21\frac{3}{4}$	$\frac{1}{4} \times \frac{1}{16}$	$\frac{1}{4} \times \frac{1}{16}$	0	0	3	$3\frac{5}{16}$	Do. do.
Trotman, ...	21	1	10	3	2	24	25	0	6	$21\frac{7}{8}$	$\frac{15}{16} \times \frac{3}{16}$	$\frac{15}{16} \times \frac{3}{16}$	$\frac{3}{16}$	$\frac{3}{16}$	8	$4\frac{3}{4}$	Wood, Brothers.
Porter, ...	20	3	7	3	2	0	24	1	7	$21\frac{1}{2}$	$\frac{7}{8} \times \frac{1}{16}$	$\frac{7}{8} \times \frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{8}$	8	$1\frac{5}{8}$	Do.
Rodgers' Kedge, .	20	1	0	4	3	14	25	0	14	21	Full. $1 \times \frac{1}{4}$	Full. $1\frac{3}{16} \times \frac{1}{4}$	$\frac{3}{16}$	$\frac{1}{4}$	8	$1\frac{1}{4}$	Fox, Henderson, & Co.
Admiralty, ...	20	2	6	4	0	3	24	2	9	$21\frac{1}{4}$	$\frac{1}{2} \times \frac{1}{16}$	$\frac{1}{2} \times \frac{1}{16}$	0	0	5	$8\frac{3}{8}$	Longridge, 1847.
Aylen, ...	21	1	0	3	3	13	25	0	13	$21\frac{3}{4}$	Full. $\frac{1}{2} \times \frac{1}{16}$	Full. $\frac{1}{2} \times \frac{1}{16}$	0	0	5	$6\frac{3}{4}$	Sheerness, 1852

These experiments were conducted under the joint superintendence of a committee of representatives of the shipowners of Great Britain—Messrs. Duncan Dunbar, Anthony Ridley, W. S. Lindsay, W. Drew, and W. Phillips, and an Admiralty committee, consisting of Capt. the Hon. Montagu Stopford, of H.M.S. *Waterloo*, 120 guns; Capt. Sup. Charles Hope, of H.M. dock-yard, and in command of the *Monarch*, 84 guns; Capt. G. R. Mundy, of the *London*, 90 guns; Mr. J. Aylen, Master-Attendant, H.M. dock-yard, Sheerness; and Mr. J. Jenkin, master of the *Waterloo*. Capt. Montagu Stopford was elected chairman, and Mr. F. J. Fegan, secretary of the committee. We ought, also, to have previously mentioned, that the parade ground at Sheerness was dug out 5 feet in depth, for a space of 250 feet by 30 feet. The soil, composed of clay and loam, was then cleared of stones, and the area filled in with soil homogeneous throughout. Whilst this was going on, two fire-engine hose furnished copious streams of water, under the impulsive power of a 50-horse engine. The surface was inclined, so that the anchors, when down to their hold, were completely immersed in water. Such ground was obviously a close resemblance to a river's bed, or a roadstead. The annexed diagram roughly illustrates the testing gear in plan. The competing anchors—starboard and port—are at A, each connected by a 14-inch cable, B, 20 fathoms in length, to the blocks, C. These blocks are 26 inches in diameter, with sheaves of $5\frac{1}{2}$ inches, serving the purpose of travellers, the cables being rove through them; and,



when triced up and down the shears, they represent long or short stays, as required. The position of the spars for the shears is indicated at D. The ends of the cables, B, are attached to the fourfold blocks, E, and at F are threefold blocks, shackled to chain-cables, G, 12 fathoms in length, and of $1\frac{1}{8}$ inch iron, terminating in anchors sunk deep in the ground. At H is the capstan, taken from a first-rate man-of-war, the centre purchase, J, from which consists of two double blocks,

1. New Admiralty. 2. Aylen. 3. Trotman. 4. Honiball. 5. Rodgers.

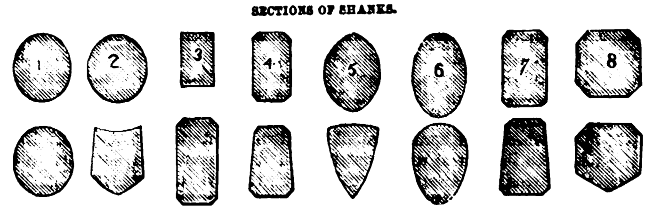


9. Isaacs. 8. Rodgers' Kedge. 7. Lennox. 6. Mitcheson.

1-8th inch = 1 foot.

passing to a single block, K. Hence ropes, L, pass to the starboard and port blocks, E. Our next illustration exhibits the whole of the anchors at one view. The numbers in the following eight sets of sections correspond to the numbers of the anchors, and the figures give the relative transverse sections of each. Resum-

SECTIONS OF SHANKS.



SECTIONS OF ARMS.

$\frac{1}{4}$ inch = 1 foot.

ing our report with the fourth day's trial, we come first to Mr. Aylen's anchor, in competition with the new Admiralty anchor. At a long scope of cable, each dragged 5 feet $10\frac{1}{2}$ inches. At short stay, the Admiralty anchor was tripped out of the

ground at a total distance of 14 feet 4½ inches from the first position, Aylen's holding on firmly, without having moved, in the least degree, from its position at long range.—Mitcheson and Son's anchor was then tested with Aylen's. The distance dragged at long scope by Mitcheson's was 4 feet 2½ inches; by Aylen's, 8 feet 4½ inches. At short stay, Aylen's was lifted out of the ground at a total distance of 19 feet 7 inches from first position, Mitcheson's holding on at 8 feet 4½ inches total.—The next trial was between Rodgers' Exhibition prize anchor, and the new Admiralty anchor. Rodgers', at long range of cable, gave way 8 feet 5 inches; the Admiralty, 10 feet. At short range, the Admiralty's tripped out of the ground at a total distance of 25 feet 1½ inch, Rodgers' holding on at 13 feet 8½ inches, showing the great superiority of holding power of the latter.—Rodgers' Exhibition prize anchor was then tried with Aylen's. Rodgers' drew 7 feet 2½ inches; Aylen's, 7 feet 5½ inches, at long range of cable. At short stay, Rodgers' held on at a total distance of 10 feet 3½ inches, lifting Aylen's out of the ground at 21 feet 9 inches from the first position.—Isaacs' American anchor was now tried against Mr. J. Aylen's. At long scope, the former drew 8 feet 7 inches; Aylen's, 2 feet 5 inches. At short stay, the American anchor was tripped out of the ground at a total distance from the first position of 18 feet 3 inches, Aylen's having dragged only 10 inches from its position at long range.—At the request of Mr. Trotman, his anchor, of 25 cwt. 0 qrs. 6 lbs., was tested against one of the new Admiralty anchors, weighing 40 cwt. 3 qrs. 7 lbs. On the first trial, at long scope of cable, Trotman's dragged 7 feet 5 inches; the Admiralty anchor, 6 feet 1 inch. On second trial at short stay, Trotman's was tripped out of the ground at 25 feet total distance from the first position, the Admiralty anchor dragging 8 inches, or a total of 6 feet 9 inches from first position. In consequence of the very great difference of weight in this last trial, amounting to 75 per cent. in favour of the Admiralty anchor, the committee suggested that Trotman's anchor should be tried against an Admiralty anchor of 35 cwt. 2 qrs. In this case, at first trial on a long scope of cable, Trotman's was dragged by the Admiralty anchor 6 feet 8 inches, the latter dragging 6 feet 7½ inches. On the second trial, at short stay, Trotman's anchor was tripped out of the ground at 26 feet total distance from first position, holding firmly to the last foot of ground. The total distance dragged by the Admiralty anchor was 10 feet 11½ inches, being a distance of 4 feet 4 inches; the Admiralty was drawn during the second experiment. This terminated the trial of anchors on dry land.—Judging from the results attained by the preceding experiments, it would appear that Trotman's improved Porter's anchor possesses fully 25 per cent. more holding properties on dry land than any other with which it has been tried. Mr. Trotman feels confident that similar results will attend the subsequent trials on the beach and at sea. We are glad to notice that Porter's original patent has been extended for six years. Mr. Honiball is the assignee of this excellent anchor, which has been still further improved by Mr. Trotman, a nephew of Mr. Honiball's. It is in use in more than 150 men-of-war, and by several steam-ship companies, but hitherto it has entailed a loss of £15,000 in working the patent.—The second series of trials have since taken place on the beach, at the back of the garrison at Sheerness. The anchors were cast in a depth of water of about two fathoms, and placed parallel to each other, at a distance of 18 feet apart, and hove up the beach by the following mode:—A pendant unites the two purchases in one, with a block on the bight, through which the pendant reeves, thus forming a traveller, one end of the pendant being made fast to one of the purchases, the other end to the other purchase, the pendant rendering through the block on the bight according to the resistance of either purchase placed on the anchors. The pendant ropes are of 8 inches and 20 fathoms, and the single block to each is of 26 inches. The small purchase leads from the block on the pendant to an anchor secured in the ground, in the centre between the two large purchases (close to the capstan), the fall of which, traversing through a leading block, is then hove round the capstan. The blocks composing the purchase are two double ones, of 18 inches each, and one single leading one of 16 inches, 113 fathoms of 5 inch rope being used for falls. The anchors were stationed in the following order:—

PORT.	STARBOARD.
No. 1. Admiralty Anchor (new).	No. 1. G. W. Lennox's.
" 2. Trotman's (improved Porter's).	" 2. Aylen's.
" 3. Mitcheson and Son's.	" 3. Rodgers' (Exhibition Prize).
" 4. Honiball's (Porter's).	" 4. Isaacs' (American).

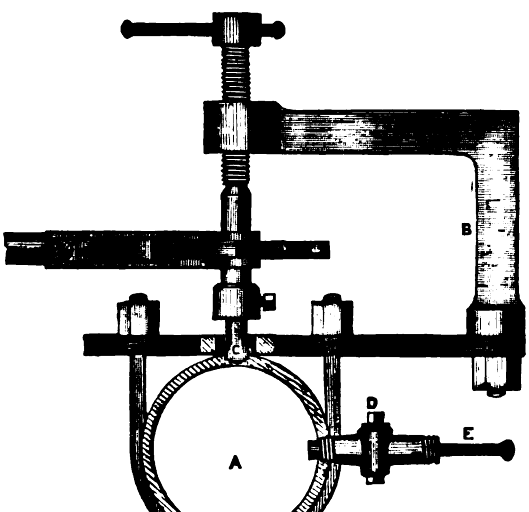
The Admiralty anchor (total weight. 24 cwt. 2 qrs. 9 lbs.) was opposed to Lennox's (total weight, 24 cwt. 2 qrs. 10 lbs.). The purchase being adjusted, and the capstan hove round, the Admiralty anchor came home 66 ft. 6 in., Lennox's 35 ft. 11 in.; thus showing the superiority of the latter's holding powers.—Trotman's improved Porter's anchor (total weight, 25 cwt. 6 lbs.) was then opposed to Aylen's anchor (total weight, 25 cwt. 13 lbs.). Trotman's was dragged through the ground 27 ft. 3 in.; Aylen's, 44 ft. 7 in., giving an advantage of 17 ft. 4 in. in favour of the former.—Mitcheson & Son's anchor (weighing 25 cwt. 14 lbs.) was then placed in competition with Rodgers' Exhibition prize anchor, of 24 cwt. 2 qrs. 22 lbs. total weight. For a considerable period after the application of the purchase, the distances each came home were nearly equal, and great interest was evinced by all present as to the result. At length, Rodgers' anchor was observed to yield, and was drawn a total distance of 54 ft. 2 in., Mitcheson & Son's coming home 48 ft., proving that the difference in their holding qualities is not very great.—The two next competing anchors were Honiball's and Isaacs' (American), the former weighing 24 cwt. 7 lbs., the latter 25 cwt. 17 lbs. In this instance, during the time Honiball's was settling in the ground, the American had the advantage, and actually drew it some few feet through the ground; but the moment Honiball's had fixed itself, all competition was at an end, the American coming home 36 ft. 8 in., as against 9 ft. 5 in. dragged by Honiball's.—Trotman's improved Porter's anchor, weighing 25 cwt. 6 lbs., had now a competitor in Lennox's anchor, of 24 cwt. 2 qrs. 10 lbs. Lennox's dragged 50 ft. 2½ in.; Trotman's, 25 ft. 4½ in.—Honiball's anchor (Porter's), weighing 24 cwt. 7 lbs., had now to contest with Mitcheson & Son's anchor, of 25 cwt. 14 lbs. For a while, the advantage of holding power was in favour of the latter; but, on Honiball's properly settling down in the ground, Mitcheson's gradually yielded to its rival, coming home 50 ft. 2½ in.; Honiball's having dragged 33 ft. 11 in.—Aylen's anchor, weighing 25 cwt. 13 lbs., was next tried against Lieutenant Rodgers' Exhibition prize anchor—total weight, 24 cwt. 2 qrs. 22 lbs. As the heaving-in proceeded, it became evident that there had been some tampering with the tackle. An immediate examination ensued, when it was discovered that some flint stones had been placed in the threefold purchase block, effectually choking it, preventing at the same time the purchase-falls working the sheaves, and lessening most materially the strain on Rodgers' anchor. As soon as the obstruction was removed, Lieutenant Rodgers' anchor came home rapidly. The result was, that Aylen's anchor came home 17 ft. 2 in., whilst Rodgers' dragged 25 ft. 1 in.—The great trial of the series now came on between Trotman's (improved Porter's) and Honiball's (Porter's) anchors. In the former trials at the dock-yard, these proved superior in holding qualities to Mitcheson & Son's, Rodgers', Lennox's, the new Admiralty, and American anchors. They were again pitted against each other, the competition causing the most intense interest, and which resulted in Trotman's bringing home Honiball's some 49 ft. 6 in. Mr. Trotman's anchor partakes, in a great measure, of the principle of Porter's. The improved construction of the former was very evident, by the immediate action of the arm penetrating into the ground within twelve feet from its original starting position, at which point it remained stationary. Trotman's improved Porter's anchor, having hitherto proved itself superior in holding power to all the others of equal weight, the Committee of Management decided on pitting it against the new Admiralty anchor on Sir W. Parker's plan, possessing an advantage, in point of weight, of 6 cwt. The trial was deeply interesting, as the distances each came home were, for a considerable period, nearly equal, rendering it doubtful which would gain the superiority, as in the annexed table:—

Fleets.	Admiralty.		Trotman.		Admiralty beat Trotman.		Trotman beat Admiralty.	
	Feet.	Inches.	Feet.	Inches.	Feet.	Inches.	Feet.	Inches.
1	8	0	9	0	6	0	—	
2	9	0	2	7	—		6	5
3	5	11	5	8	—		0	3
4	4	11	4	7	—		0	4
5	4	8½	4	4½	0	1	—	
6	4	0	4	1	0	1	—	
7	6	2½	5	8	—		0	6½
8	12	3½	0	4	—		11	11½
Total,....	49	7½	36	8½	6	2	19	6

From the above statement will be seen the immense superior advantage, as regards holding properties, of Trotman's anchor, the more especially by taking into consideration the much greater weight of its rival, which it drew through the ground a greater distance by 13 ft. 4 in. Mr. Trotman's anchor differs from "Porter's" by an increased area of resistance to insure the arm biting into the ground: this is combined with a peculiar angle ingeniously given to the palm, which causes the arm continually to deepen in proportion to the strain brought on the cable. This fact was fully demonstrated as the tide receded, the anchor in question being quite underground at the stock end, some 18 inches, the first link of the chain showing at a distance of 28 feet, while the flukes were quite buried.—A further trial afterwards took place between Aylen's and Rodgers' Exhibition prize anchors. Rodgers' came home 23 ft. 8 in.; Aylen's, 50 ft. 10 in. When tested in the same ground, on the 31st July, Aylen's beat its competitor by 7 ft. 11 in.—To conclude the trials, the committee have resolved to bring the whole of the anchors to the breaking test. We shall next month report upon the result of the intervening trials to come off before this final *experimentum crucis*; but we can pretty clearly foresee that Trotman's must prove the best. Since this report was written, the third series of trials has taken place at Black Stakes in the Medway, lighters being moored there for the operations. On this occasion, the points attended to were—canting, quickness in taking hold, biting and deepening into the ground, and holding powers at short-stay-peak. Trotman's, the Admiralty (Sir W. Parker's), Lennox's, and Mitcheson's anchors, were stationed on the port side; Aylen's, Rodger's Exhibition prize anchor, Honiball's (Porter's), and Isaac's (American), on the starboard side of the Royal Escape lighter, being secured in a similar manner to that adopted on board ship. The ends of a 25-fathom length of 1⅝ inch chain cable were shackled on to the competing anchors, port and starboard, with a large traversing iron block in the centre; this, again, was brought to a chain pendant over the horn or derrick of a dockyard lighter, and, with a fourfold purchase attached, brought to the capstan. At a signal from the gallant commodore, the lashings holding the first pair of competing anchors (Trotman's and Aylen's) were cut, and they dropped in 10 fathoms water. The heaving-in process commenced immediately, Trotman's bringing Aylen's home. The next trial was between Lennox's and Isaac's (American) anchors, the former beating the latter considerably. Lieutenant Rodger's Exhibition prize anchor was then placed in competition with the new Admiralty anchor constructed on the plan of Sir W. Parker, the former evincing a superiority over the latter. Honiball's (Porter's) and Mitcheson's anchors were then opposed to each other, but both fouled their stocks in dropping, and another trial was consequently determined on. Trotman's and Lennox's were

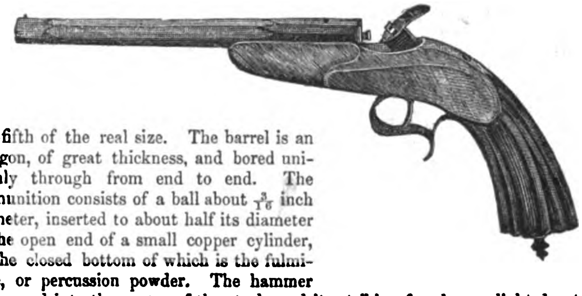
then tested, ending in Trotman's bringing home its adversary. This was succeeded by Rodger's Exhibition prize against Mitcheson and Son's, and, after very heavy straining, and two hours heaving-in, Rodger's was brought home. During these trials, the following resolution of the committee was submitted to the competitors:—"That as it is desirable the report of the committee should be accompanied by correct models of the competing anchors, so as to serve as records of the present state of anchor art, the owners of the several anchors be invited to furnish correct models, in gunmetal, on the scale of three-quarters of an inch to the foot." A whole day was now taken up in testing Honiball's and Mitcheson's, and, after a most arduous test, Honiball's was hove up. Trotman's and Mitcheson's were then tried, and Trotman's was brought home. This was a most unexpected result, inasmuch as Trotman's superiority had hitherto been undeniable. It is conjectured that the broken nature of the ground on the port side, where Trotman's was placed, was mainly instrumental in causing the failure. In Aylen v. Lennox, the former was the victor.

MACNEILL'S SYSTEM OF FORMING WATER-WAY CONNECTIONS IN FULL-PRESSURE WATER-MAINS.—Every one who is dependent on a public company for his water-supply, must have frequently suffered annoyance and inconvenience from the periodical withdrawal of the water from the mains. Much of this, of course, arises from the unavoidable necessities of repairs, accidents, and occasional reorganization of works; but much is also due to the existing mode of procedure in boring into the mains for the mere connection of a diverging branch for the common supply, a mode which is equally as troublesome and expensive to the water company, as it is inconvenient to the consumer. For example, in the cases of such large works as those of Liverpool, where the supply is brought through 44-inch pipes from Rivington Pike; and the Corporation works of Manchester; and the Gorbals works at Glasgow, which are similarly supplied, the connection of a diverging branch for the supply of a few houses, or a manufacturing establishment, frequently involves the running off of several miles' length of main, full of water. In the Gorbals works, for example, the addition of a branch pipe to any portion of the main without the precincts of the town, would cause the loss of all the water in the 24-inch pipe, from the stop-valve at the reservoirs to the valve next below the scene of the junction, a distance of four or five miles. To remedy this objection, Mr. Macneill of the Gorbals establishment has introduced a simple plan, whereby he is enabled to bore the main, and screw in a stop-cock, without meddling with the pressure in the main, or losing more than a few drops of water. Our illustration exhibits the borer in action, as well as the insertion of the stop-cock when the pipe



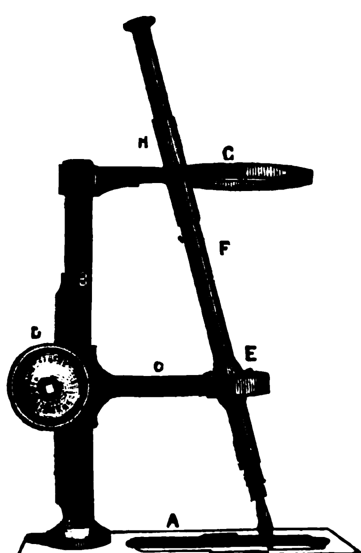
has been bored and tapped. This particular form of borer is due to Mr. M'Culloch of Kilmarnock, who has given some attention to the extension of the plan. The main, A, is represented in transverse section, the drill-frame, B, being bolted or clamped to it by a strap and top-plate. The drill-spindle is actuated by the ordinary ratchet wheel and lever, but the drill, C, differs from the usual form in being formed with its cutting edges joining at a very obtuse angle. The bore is carried on with this drill until the water just oozes through the pipe, as the point of the drill penetrates to the interior. This drill is then changed for a flat or rectangular faced one, and the hole is carried down square in this way until a mere thin film of metal intervenes between the drill face and the interior of the pipe. The hole is now tapped, and the stop-cock, formed with two straight branches, with a circular water-way through the plug, is screwed in. The plug of the cock is kept open, and a straight drift is passed through the two branches and the plug, and the thin body of metal left by the flat drill is thus driven into the main, the plug being turned to close the discharge as the drift is withdrawn. The drill, C, on the top side of the main, is the first that is used, the point being shown as just entering through the metal; whilst the outside dotted lines represent the hole after the use of the flat drill. The stop-cock, D, at the side of the pipe, is represented as just screwed into a hole so bored, with the drift, E, driven through it to complete the communication. Our water companies ought to feel indebted to Messrs. Macneill and M'Culloch for so simple a contrivance, which must undoubtedly be received in the manner which its practical value deserves.

PERCUSSION PISTOL.—We have lately been shown an elegant little fire-arm, invented by M. Flôbert of Paris, for the purpose of shooting ball by the mere force of a small percussion-cap. Our engraving shows the pistol on a scale of about



one-fifth of the real size. The barrel is an octagon, of great thickness, and bored uniformly through from end to end. The ammunition consists of a ball about $\frac{3}{16}$ inch diameter, inserted to about half its diameter in the open end of a small copper cylinder, in the closed bottom of which is the fulminate, or percussion powder. The hammer is recessed into the centre of the stock, and its striking face has a slight dovetailed piece upon it, which, when the cap is struck, prevents the flying off of the metal. We have represented the piece at full cock, the hammer being fully drawn back. On pulling the trigger, the blow explodes the fulminate, and the pea ball is driven through the barrel with surprising force. No powder or wadding being required, the loading is a matter of the utmost simplicity, and hence the pistol is well adapted for indoor practice. The form of the stock is particularly neat, and its general getting-up deserves some praise. Mr. J. D. Dougall, the well-known gun-maker of Glasgow, who has drawn our attention to this pistol, is of opinion, that the principle is applicable for a much more extended range of purposes than we have mentioned above. Very good practice has been made with it, at tolerably long distances; and at 25 yards, the ball goes through a $1\frac{1}{2}$ inch plank.

HICK'S ISOMETRICAL PERSPECTIVE ELLIPTOGRAPH.—The practice of drawing in isometrical perspective—a style so peculiarly adapted for the representation of mechanical and architectural subjects in three combined aspects—has found a useful assistant in Mr. Hick's Elliptograph. The annexed engraving represents this contrivance in working order, as fitted with a pen for drawing ellipses in ink. It consists of a rectangular base plate, A, having sharp countersunk points on its lower surface, to hold the instrument steady, and cut out to leave a sufficient area of the paper uncovered for the traverse of the pen. It is adjusted in position by four index lines, setting out the transverse and conjugate axes of the intended ellipse—these lines being cut on the inner edges of the base. Near one end of the latter, a vertical pillar, B, is screwed down, for the purpose of carrying the traversing slide-arm, C, adjustable at any height, by a milled head, D, the spindle of which carries a pinion in gear, with a rack on the outside of the pillar. The outer end of the arm, C, terminates in a ring, with a universal joint, E, through which the pen or pencil holder, F, is passed. The pillar, B, also carries at its upper end,



a fixed arm, G, formed as an elliptical guide frame, being accurately cut out to an elliptical figure, as the nucleus of all the varieties of ellipse to be drawn. The centre of this ellipse is, of course, set directly over the centre of the universal joint, E, and the pen holder is passed through the guide and through the joint, the flat sided sliding-piece, H, being kept in contact with the guide, in traversing the pen over the paper. The pen thus turns upon its joint, E, as a centre, and is always held in its proper line of motion by the action of the slider, H. The distance between the guide ellipse, and the universal joint, determines the size of the ellipse, which, in the instrument before us, ranges from $2\frac{1}{4}$ inches by $1\frac{5}{8}$, to $\frac{7}{16}$ by $\frac{1}{4}$ inch. The instrument from which our "engraved photograph" has been taken, is a good example of the workmanship of Mr. Dancer, the optician of Manchester.

COALS AND WATER AS ELEMENTS OF MECHANICAL POWER.—By the steam-engine coals are made to spin, weave, dye, print, and dress silks, cottons, woollens, and other cloths; to make paper, and print books upon it when made; to convert corn into flour; to express oil from the olive, and wine from the grape; to draw up metal from the bowels of the earth; to pound and smelt it, to melt and mould it; to forge it; to roll it, and to fashion it into every desirable form; to transport these manifold products of its own labour to the doors of those for

whose convenience they are produced; to carry persons and goods over rivers, lakes, seas, and oceans, in opposition alike to the natural difficulties of wind and water; to carry the wind-bound ship out of port; to take the vessel of war, and place her side by side with the enemy; to transport persons and intelligence over the surface of the deep, and to convey them by land from town to town, and from country to country, with a speed as much exceeding that of the ordinary wind, as the ordinary wind exceeds that of a common pedestrian. Such are the virtues, such the powers, which the steam-engine has conferred upon coals. The means of calling these powers into activity are supplied by a substance which nature has happily provided in unbounded quantity in every part of the earth; and though it has no price, it has inestimable value: this substance is water.

FACTS ABOUT RAILWAYS.—The combined half-yearly reports of sixty-seven railway companies of the United Kingdom, for the latter half of 1851, show, on the credit side of their ledger, a gross receipt of £8,293,720, the total expenditure, or the cost of producing this sum, being £3,568,080—equal to a return of 2·04 per cent. for the half-year. The entire length of line included in this statement is £6,536 miles, the average cost of construction of which was £35,448 per mile. The receipts, per mile, come to £1,242, and the expenses, £534, leaving £708 per mile for interest on the cost and other details. An analysis of the lines in each country shows, that on forty-two English lines, of a total length of 5,027 miles, the return was 2·16 per cent. for the half-year. The average cost of construction was £38,290 per mile; receipts, £1,439; expenses, £614; or 42·67 per cent.—leaving £824 per mile as the profitable return. Again, on eleven Scottish lines, of an aggregate length of 912 miles, the return was at the rate of 1·458 per cent. The cost of making was £30,781 per mile; receipts, £828; expenses, £378; or 46·29 per cent.—leaving a working profit of £449 per mile. In Ireland, fourteen lines, with a total length of 597 miles, gives a return of 1·607 per cent. Cost of construction, £18,639 per mile; receipts, £528; expenses, £228—leaving a profit of £300 per mile.

ENGLISH PATENTS.

Sealed from 16th August, to 18th September, 1852.

Henry Needham Scrope Shrapnel, Gosport,—"Improvements in ordnance and fire-arms, cartridges, and ammunition or projectiles, and the mode of making up or preparing the same."—August 23d.

Frederick Dam, Brussels, chemist,—"Improvements in preventing incrustation in boilers."—23d.

Josiah George Jennings, Great Charlotte-street, Blackfriars-road, brass-founder,—"Improvements in water-closets, in traps and valves, and in pumps."—23d.

Julius Roberts, Portsmouth, lieutenant in the Royal Marine Artillery,—"Improvements in the mariner's compass."—23d.

Auguste Edouard Loradoux Bellford, Castle-street, Holborn,—"Improvements in the machinery and apparatus for printing fabrics, and other surfaces."—(Communication.)—26th.

Paul Joseph Poggioli, Paris, France, gentleman,—"An improved medical compound."—26th.

George Twigg, Birmingham, button manufacturer,—"Certain improvements in the manufacture of buttons and other dress fastenings, and in the machinery and apparatus to be used therein."—26th.

Charles Cowper, Southampton-buildings, Chancery-lane, Middlesex,—"Improvements in the application of iron to building purposes."—(Communication.)—26th.

John Fish, Oswaldtwistle, Lancaster,—"Certain improvements in looms for weaving."—26th.

Andrew Crosse, Broomfield, Somerset, Esq.,—"Improvements in the extraction of metals from their ores."—26th.

Pierre Amable de Saint Simon Sicard, chemist, Paris,—"Improvements in enabling persons to remain under water and in noxious vapours."—26th.

James Lawrence, Colnbrook, Middlesex, brewer,—"Improvements in brewing apparatus."—26th.

William Henry James, Great Charlotte-street, Surrey, civil engineer,—"Improvements in heating and refrigerating, and in apparatus connected therewith."—September 3d.

Peter Armand Lecomte de Fontainemoreau, South-street, Finsbury,—"Improvements in producing gas, and in its application to heat and light."—(Communication.)—7th.

John James, Leadenhall-street, London, manufacturer,—"Certain improvements in weighing machines and weighing cranes."—9th.

Henri Francois Toussaint, Paris, gentleman,—"Improvements in obtaining a product from the wood of the cactus."—10th.

Julian Bernard, Guildford-street, Russell-square, Middlesex, gentleman,—"Improvements in the manufacture or production of boots and shoes, and in materials, machinery, and apparatus connected therewith."—10th.

John Wright Treeby, Elizabethan Villa, St. John's Wood, Middlesex, gentleman,—"Improvements in regulating the flow of liquids."—10th.

Stephen Taylor, New York, gentleman,—"Certain improvements in the construction of fire-arms, and in cartridges for charging the same."—10th.

Alexander Stewart, Glasgow, North Britain, manufacturer,—"Improvements in the manufacture or production of ornamental fabrics."—10th.

Frederick Sang, 58 Pall-mall, Middlesex, artist in fresco,—"Certain improvements in floating and moving vessels, vehicles, and other bodies, on and over water."—16th.

Charles Augustus Peller, Abchurch-lane, London, merchant; John Eastwood, Bradford, York, woolcomber; and Samuel Gamble, of Bradford aforesaid, machine-maker,—"Improvements in machinery for combing, drawing, or preparing wool, cotton, silk, hair, and other fibrous materials."—16th.

SCOTCH PATENTS.

Sealed from 22d July, to 22d August, 1852.

Joseph Haythorne Reed (late of the 17th Lancers), Harrow-road, Middlesex, gentleman,—"Improvements in saddlery and harness."—2d August.

William Edward Newton, Office for Patents, 66 Chancery-lane, Middlesex, civil engineer,—"Improvements in the construction of wheels for carriages."—(Communication.)—3d.

John Gerald Potter, Over Darwen, Lancaster, carpet manufacturer, and Matthew Smith, of the same place, manager,—"Certain improvements in the manufacture of carpets, rugs, and other similar fabrics."—6th.

Ralph Errington Ridley, Hexham, Northumberland, tanner,—"Improvements in cutting and reaping machines."—6th.

William Ackroyd, Birkenshaw, near Leeds,—"Improvements in the manufacture of yarn and fabrics, when cotton, wool, and silk are employed."—6th.

Alfred Vincent Newton, Office for Patents, 66 Chancery-lane, Middlesex, mechanical draughtsman,—"Improvements in the manufacture of metallic fences, which improvements are also applicable to the manufacture of verandas, to truss frames for bridges, and to other analogous manufactures."—(Communication.)—13th.

Robert Hardman, Bolton-le-Moors, Lancaster, mechanic,—"Improvements in looms for weaving."—18th.

James Pilling, Rochdale, Lancaster,—"Certain improvements in looms for weaving."—20th.

IRISH PATENTS.

Sealed from 18th July, to 18th August, 1852.

Robert John Smyth, Islington, Middlesex,—"Certain improvements in machinery or apparatus for steering ships and other vessels."—19th July.

Frederick Sang, 58 Pall-mall, Middlesex, artist in fresco,—"Certain improvements in machinery or apparatus for cutting, sawing, grinding, and polishing."—19th.

Richard Archibald Brooman, of the firm of J. C. Robertson & Co., 166 Fleet-street, London, patent agents,—"Improvements in the purification and decoloration of oils, and in the apparatus employed therein."—(Communication.)—19th.

Richard Parris, Long-acre, Middlesex, modeller,—"Improvements in machinery or apparatus for cutting and shaping cork."—22d.

Joseph Maudslay, of the firm of Maudslay, Sons, & Field, Lambeth, Surrey, engineers,—"Improvements in steam engines, which are also applicable wholly, or in part, to pumps and other motive machines."—22d.

Charles Augustus Preller, Abchurch-lane, London, gentleman,—"Improvements in the preparation and preservation of skins and animal and vegetable substances."—22d.

James Joseph Brunet, Canal Iron Works, Poplar, Middlesex, engineer,—"Certain improved combinations of materials in ship-building."—(Communicated to him by Lucien Armaud, Bordeaux, France.)—5th August.

Henry Graham William Wagstaff, Bethnal-green, Middlesex, candlemaker,—"Improvements in the manufacture of candles."—5th.

Edmund Morewood, Enfield, Middlesex, and George Rogers, of the same place, gentleman,—"Improvements in the manufacture of metals, and in coating or covering metals."—5th.

Ralph Errington Ridley, Hexham, Northumberland, tanner,—"Improvements in cutting and reaping machines."—5th.

George Laycock, late of Albany, United States, America, dyer, now of Doncaster, York, farmer,—"Improvements in unhairing and tanning skins."—6th.

James Warren, Montague-terrace, Mile-end-road, gentleman,—"Improvements applicable to railways and railway carriages, and improvements in paving applicable to bridges and flooring."—17th.

Francis Joseph Beltzung, Paris, France, engineer,—"Improvements in the manufacture of bottles and jars of glass, clay, gutta percha, or other plastic materials, and stoppers for the same, and in machinery for pressing and moulding the said materials."—17th.

DESIGNS FOR ARTICLES OF UTILITY.

Registered from 15th August, to 18th Sept., 1852.

August 19th,	3353	J. Newman, Soho-square,—"Colour-box."
21st,	3354	S. S. Phillips, Chelmsford,—"Hot-water stove."
24th,	3355	T. Gibson, jun., Manchester,—"Shirt front."
26th,	3356	F. G. Yates, Winkworth's-buildings,—"Lever-knife."
—	3357	F. G. Yates, Winkworth's-buildings,—"Box for string, &c."
28th,	3358	C. Carr, Stockport,—"Spindle, rail, and bearings, for spinning, doubling, and winding machines."
—	3359	R. Clark, Strand,—"Fastening for the nozzle of candle-lamps."
—	3360	W. Sanderson, Sheffield,—"Balance handle for knives and forks, and table steels."
30th,	3361	E. Harris, Ebby, near Stroud,—"Corrugated zinc wash slab."
31st,	3362	J. Dicker, Islington,—"Traductor."
Sept. 2d,	3363	J. Blackwood & Co., Long-acre,—"Tablet diary."
—	3364	Deane, Dray, & Co., London-bridge,—"Gas stove."
4th,	3365	J. Higgins, Oldham,—"Hollow furnace door-frame for steam-boilers."
6th,	3366	W. Estwick, Hoxton,—"Ventilating tent."
—	3367	R. Grundy, Rio de Janeiro,—"Boat crane."
8th,	3368	T. Young, Little Todrig, Scotland,—"Traction apparatus for horse thrashing machines."
11th,	3369.	A. Aubert, Nantes, France,—"Oyster-opener."
15th,	3370.	S. & M. Meyer, Bow-lane, Cheapside,—"Joint for parasols, umbrellas, fishing-rods, &c."

DESIGNS FOR ARTICLES OF UTILITY.

Provisionally Registered from 15th August, to 18th September, 1852.

August 25th,	458	J. V. N. Bazalgette, Devonshire-street,—"Brickmakers' rotary moulding table."
26th,	459	J. Cooper, Birmingham,—"Joiner's brace."
28th,	460	H. & G. Turner, Ipswich,—"Garment."
Sept. 1st,	461	P. Effertz & E. Zorn, Wellington-street,—"Separation."
—	462	W. D. Hornsby, Bartholomew-close, T. A. Burrage, St. John's-square, I. L. Barber, Norwich,—"Netting pattern type."
7th,	463	D. S. Brown, Old Kent-road,—"Ship."
8th,	464	W. Howard, Maze Pond,—"Ash-pan fender."
13th,	465	J. Magness, Upper Southwick-street,—"Oval chimney valve."
14th,	466	J. Brown, Upper Norton-street,—"Combined cigar-holder and piercer."

TO READERS AND CORRESPONDENTS.

RECEIVED.—"Astronomical Observations made at the Royal Observatory, Edinburgh."—"Report on the Supply of Water to the Town of Swansea." By Michael Scott.—"On the Management of Ships' Boats." By W. S. Lacon, Esq.—"Fragments in Defence of Animals."—"Outline of Ship-Building."

APALACHICOLA.—The lateness of our receipt of this communication, prevents us from noticing it in the present number; we shall give it a place in the November part. We have to repeat, that however much we are gratified by so distant an echo to our labours, we yet think such compliments ought to be franked: this cost us 4s.

R. F.—We shall engrave his ingenious contrivance for part 56.

C. H. H., U.S.—Received, and will be attended to next month.

THE PLEASURES OF SCIENCE.

In noticing, as, in our recent papers on the subject, we have done, some of the benefits of science, many of the pleasures attending its prosecution have necessarily been anticipated: a few others must not pass without a word.

The gratification resulting from the observation of any fact new to us, may have been designed, as it often proves, as an incentive to larger inquiry. This incentive becomes greater or less as the new fact or truth discovered, has been brought to light by our own industry or that of another. We are habituated to learn the latter as another sort of A B C. It is impossible to rise from the easy perusal of such tales without some feeling of delight; but how greatly this feeling is enhanced when the new thing bursts upon us as a fresh creation—beautiful in very novelty, in very simplicity! A new acquaintance in the universe seems to have sprung up at the magic touch of our will-wand—a new acquaintance, of kindly social habits and modes of existence, who possesses elements akin to the well-remembered tones which we have loved, from that far-distant and indefinite time when we were not as yet set apart from all-surrounding power to perform our duty. We hail every new-comer of this kind as a very first-born, and it is tended and cherished accordingly; and every act of solicitude impresses but deeper and deeper that sentiment—or what else (we know not a name for it)—which tramples down all sorrow, and imparts to us, while being blessed, the abundant joy of blessing. The pursuit of science, dry! Why, at every turn new delight of this order springs up. Even when "at fault," what strange things come pouring in upon us—strange yet pleasant to behold, if to be seen for a moment, and then to vanish away for ever, comprise but the beginning and the ending of their existence. The pursuit of science, dry! Why, if the pursuit be real, we must—we cannot fail, at every step well made, (and by this can we trace our progress,) to find new gratifications. Each delight renews delight. Haply, eagerly pushing our inquiry, an unknown and totally unexpected proof comes stark naked before us, of some splendid truth in another. We at such times are made to feel, that every new class of knowledge becomes as a new sense. It is an additional means of measuring higher truth, or of penetrating the clouds or mist by which it has hitherto been shrouded. There is something interesting even in the bare knowledge (that is, when brought home by experiment to the reasonable conviction), that the bright colourless light of day is composed of three colours—blue, red, and yellow, and that these are apparently disposed in space in degree analogous to the laws of the "concord of sweet sounds" in music; the proportion of blue being 3, of the red, 5, and of the yellow, 8. We recollect well the time when it became very interesting to feel assured that these three colours, blended in varying proportions, produce all the variety of tints that we see around. We can see ourselves now the happy little schoolboy, be-pinafored and be-frilled, watching with interest the nomadic lecturer in our school-room, performing his magical miracles, which he helped us to teach ourselves were neither miraculous nor magical. Those two transparent liquids—colourless by night-light—(we never shall forget them)—how deeply blue they became when simply jostled against each other! Then, again, that intense black produced by the combination of those two others. Then came the crowning "experiment" of all: the solid made from two liquids. And when the itinerant chatterer ceased his chorus, and reversed before the eyes of his lookers-on, rather than auditors, the long-bodied test-glass which lately held the limpid atoms, and they were observed to disregard the law which so recently would have urged them with wasting speed to the earth, how did the feeling pervading then that youthful mass go round, uttered in all manner of imaginable sounds, from the low, scarcely audible, involuntary breathing, to the clapping of hands, which bespoke more the praise of Goody Nature herself, than of the means shut up in that spare hard-travelled form by which the fact was successfully brought home to our urchin understanding! It was the same thing over and over again, when such wonders were made manifold. Whether it was the bringing together two inodoriferous substances, and thereby creating one most pungent; or the mixture of two cold liquids to produce great heat; or simply touching another (the iodide of nitrogen) with a cold substance in the open air, and causing it to explode with violence; what did it signify? each afforded its own measure of delight, and, literally, opened the mind to the reception of all other facts. Nor is the wonder thus excited a thing of time—a thing, like some others, which are to be remembered only as having once had place in childhood or in youth. It was with the same zest that we turned our attention to the copper and the zinc, and the acid and the coil of insulated wire and the little iron rod, and *saw* the winged words fly far, far off, and come back again to us, though mountains and valleys, and our own girting sea, lay between. Was there no pleasure in feeling present with our friends in their immediate enjoyments, or, presently, sympathising in their deep grief, the knowledge of which fell with greater power through the instrumentality of "the electric telegraph"? Science, or the pursuit of science, dry, indeed! When we are made to see two rays of light produce darkness—lamps burning without flame, when we know that light, and heat, and sound, are, like ourselves, but passengers through the universe—that linen rags are capable of producing more than their own weight of sugar, when treated with one of the cheapest and most abundant acids, the sulphuric; and that sawdust itself is susceptible of conversion into a substance bearing no remote analogy to bread, and which has been described as, although, certainly, less palatable than that made of flour, yet as being noway disagreeable, but both wholesome and digestible, as well as nutritious;*—we are called upon to bear our testimony to the charms of scientific investigation, and the intense gratification which its results are capable of affording. How did our heart burn within us when, but the other day—Saturday, at one o'clock—we strayed into "Bartholomew's" to see the advantages of chloroform! There was the little silent "theatre," with the youthful intelligences arranged on the semicircular standing-places; there was the "operator of the day," abstracted from everything around, except "the case" before him, looking both serious and thinking; and there was the patient to be operated upon. The business of the day commences. The handkerchief, saturated with the magic anæsthetic, is duly applied. As one devotes himself to this—some favourite or more advanced pupil—another intently watches the slow sinking of the pulse. All becomes hushed as death, and more than its half-brother, sleep, is now there. A strange sentiment, before unexperienced, suffuses the whole frame—a sentiment mingling many passions. But scarcely is there time to feel this new kind of sense (for nothing but that can it be called), when a smothered buzz, ushering in a reassuring universal smile, is observed around—the fact itself speaking forth its eloquent tale of the complete and painless removal of the pressure upon poor suffering humanity.

Such-like simple facts are, doubtless, sufficiently interesting of themselves; but when we consider (where we are able to do so) the general laws which appear to control them, and the increased knowledge which our enlarged acquaintance with these laws has afforded, we can scarcely fail to be intensely gratified with the singular power which is attained. It has been stated, that the great comparative anatomist, Cuvier, was able to construct the entire skeleton of the megatherium—a huge and strange animal, found only in a fossil form—from deductions made with almost the certainty of mathematical investigation, from the peculiarly modified structure of a small knob, or bony process, in one of the joints of the foot; and Professor Agassiz, from a single scale, found in a coprolite of a fossil species of fish-lizard, was enabled not only to tell the order, genus, and species of fish to which the scale had belonged, but even the particular part of the body of which, innumerable ages ago, it had formed so insignificant a part.

* Sir J. Herschel's Prel. Disc., p. 59.

Now these results, when first objected to us, appear very extraordinary and unaccountable, but in reality they were attained, and are attainable, by the most simple means; the fame of the discoverers, in this respect, resting in the discovery of those *means*. After patient scientific pursuit, Cuvier observed that the carnivorous quadrupeds were furnished with sharp, tearing teeth and claws like the cat; that their bones and muscles, and nervous system, were all admirably proportioned to effect the procuration and mastication of their natural food—flesh; and that, on the contrary, the herbivorous animals were endowed with a dental structure of peculiar bluntness; some, like the horse, possessing incisors to bite off their vegetable food, and others, without such incisors, but possessing strong claws to dig for the roots of the earth, or the elegant "trunk" enabling them to feed on the fruits, or leaves of trees. Molar teeth to these latter are alone necessary to effect mastication. From observation of such simple facts, he inferred and proved the great and significant law, that every living being forms a whole—a single and complete system—all the parts of which correspond to one another, and by their reciprocal action, contribute to, and bear upon, the same end; that no part can be changed without a change of the others, and that every part taken alone, points to, and gives the whole. Knowing the peculiar structure of a bone, which was adapted to an ungual phalanx, or claw in the foot, he reasoned, that if such a bone be of *such* a structure, the bone contiguous must be of *such* a structure, and so on until he had elaborated his wonderful work in restoring to sight, and in creating afresh, as it were, for the sight of *man*, the osteological construction of this singular creature. Again, in the case of the scale: Agassiz, in his minute and indefatigable researches into Ichthyology, or the natural history of fishes, had observed a difference in their scales, by which he was enabled to class all fishes into four great families: the Placoid, the Ganoid, the Ctenoid, and the Cycloid—each exhibiting peculiarities of its own. In prosecuting his observations, he found a series of somewhat modified scales on each side of every fish, covering and protecting a duct for the passage of a lubricating mucus, of great importance to the creature's economy, extending from the glands of the head to the extremity of the body. By increased minute and careful observation, he discovered that each of the scales thus protecting this mucus duct, differed in some particulars, and was modified in structure according to the side of the fish on which it was situated, and its position on the body. Hence he became enabled to detect the obscure and detached remain, which could be referred only generally by the deeply-regretted Dean of Westminster—who showed it to the distinguished French naturalist—to some unknown fish of the numerous species that occur in the lias formation in which the coprolite was found.

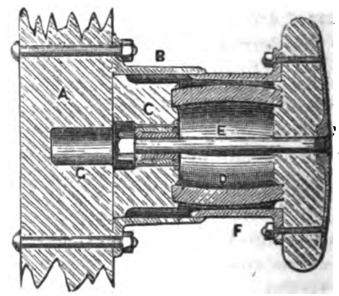
Again, the various and interesting properties of numbers have made many suppose that there is a charm hanging about them. We may, at present, smile at what is recorded of the heathen Pythagoras, who invocated the number 4; that in the number 3, he thought many wonderful properties existed; while to the mysterious energy of numbers themselves, he ascribed the formation of all things! Every schoolboy recollects the story told of this same philosopher, who, on discovering the equality subsisting between the squares of the sides of a right-angled triangle, and the square of the hypothenuse, was so delighted as to sacrifice to his gods a hundred head of cattle. The observation of the relation between the solidity of a sphere and that of a cylinder of the same diameter and height, is said to have so elated Archimedes, as to induce him to desire the visible figures to be inscribed upon his tomb, together with numbers which express the relation, and which he ascertained to be—the sphere two-thirds of the cylinder. The same philosopher, upon discovering the problem of specific gravity, while partaking of the natural luxury of the bath, in the first transports of feeling, and thinking of nothing else, rushed out into the streets of the crowded city, exclaiming "I have found it out! I have found it out!"

We had proposed to conclude this paper with some observations more immediately connected with the ordinary pursuits of our readers; but have yet a few other matters which must first be noticed, and which we purpose to enter upon at a future time.

COLEMAN'S LOCOMOTIVE ENGINE AND TENDER BUFFERS.

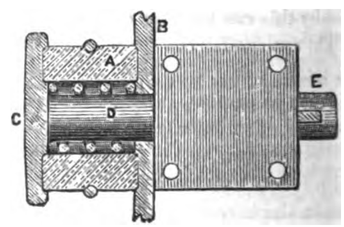
As a note to our article on "Coleman's Improvements in Springs, and in the Application of Elastic Materials," in our October part,* we add the annexed illustrations of two other forms of buffers, respectively intended for the front buffers of locomotives, and the intermediate buffers for the engine and tender. Fig. 1 is a longitudinal section of the locomotive buffer, as made for the eighteen-inch cylinder large express engines, which Mr. M'Connell intends to run in two hours, between London and Birmingham. The buffer-beam, A, six inches in thickness, has bolted to it the short open-ended cast-iron cylinder, B, which encircles a solid projecting cylinder of wood, C, forming both an abutment for the end pressure of the elastic india-rubber cylinder, D, and a horizontal guide for the traversing spindle, E, of the buffer-head. The hollow india-rubber cylinder, when put in, is eight inches in length, by seven inches in diameter, the thickness of the elastic material being one inch. It is contained within the cast-iron traversing cylinder, F, bolted to the inside of the buffer-head, and fitted to work within the fixed cylinder, B. A shallow annular groove is turned out of the inside of the buffer-head, to receive the front end of the elastic cylinder, and the hind end is similarly received by a groove turned out of the front of the piece of wood, C. The guide-spindle, E, has a countersunk head, and is screwed into the central eye of the thin buffing-plate, bolted to the buffer-head. It works through a short brass socket, fast in the centre of the piece of wood, C, and is prevented from coming forward by a nut behind—a recess, G, being cut in the buffer-bar, to allow of the traverse during the buffing action. The elastic cylinder may be filled either with water or air, or a combination of the two. Fig. 2 is a section of a still simpler arrangement, and is designed for coming between the engine and tender. The india-rubber cylinder, A, surrounded by a single metal retaining ring, is slightly recessed at one end into the front of the metal plate, B, of the tender, and at the other it projects to the same distance into an annular groove in the buffing-head, C, forged in one piece with the guide-spindle, D, connected to the tender at its opposite end, E, by a cutter. This spindle is thus the guide for the buffing action, the india-rubber cylinder being entered upon it with a helical coil of metal, between the metal and the india-rubber surfaces. Such a plan of construction is evidently excessively cheap, whilst there is nothing in it to go out of order.

Fig. 1.



1-12th.

Fig. 2.



1-8th.

* Page 154, ante.

ON THE GENERATION OF COLD BY THE EXPANSION OF ATMOSPHERIC AIR ARTIFICIALLY COMPRESSED.

By John Gorrie, M.D.

My attention has been recently called to an editorial notice in the *Practical Mechanic's Journal* (vol. iii., p. 238), of some notes on an invention of mine for the artificial production of ice. In the same volume, pp. 155—157, and 194—198, there is an elaborate essay "On a Method of Cooling the Air of Rooms in Tropical Climates, by Professor Piazzi Smyth, Astronomer-Royal for Scotland," which you think both anticipates my discovery, and supersedes the necessity for an account of the

principle it involves. "Professor Smyth," the notice says, "compresses his air, cools it whilst in its highly condensed state, and, allowing it to expand, admits it in its cooled condition to the apartment under treatment;" while I, "instead of setting free the condensed air in the open space of a room, cause it to expand in contact with water,* from which it absorbs the heat due to its expansion." Upon this brief statement of the principles brought into requisition, you contend that my plan is identical with, or simply an extension of, Professor Smyth's. Permit me to suggest that you have taken too limited and inadequate a view of this subject, and to request that you will admit into the columns of your Journal, the following comments on it, as well as on Professor Smyth's device, and the natural laws with which it is connected. Their publication will, I think, show that, in common with the scientific world, neither you nor Professor Smyth accurately understand the relation of air to heat; that the bounds of science may be extended by its further explanation; and that, fully understood, the knowledge admits of being applied so as to greatly ameliorate the condition of a large portion of mankind.

The range of physical science hardly admits of a more familiar fact, than that the condensation of atmospheric air evolves heat. The converse of this position, or, that expansion absorbs heat, is equally true, and is the foundation of all attempts to produce artificial cold from air. The constant relations of action and reaction, of number and quantity, between physical and chemical forces, induce us to infer, as a deduction from universal natural law, that this absorption of heat in expansion is the same in quantity as that displaced in a corresponding condensation. Partial causes may produce an apparent difference, but the intervention of no circumstance can prevent this actual equality. But though these quantities are equal and invariable, the law, up to the present time, must be considered as only logically, or, at the utmost, approximatively established; for in the experiments hitherto made to demonstrate the fact, there has always been a wasteful or nugatory application of the principle of expansion. In this respect, our control over the affinity of air for caloric, seems to be subject to difficulties like those we find in attempting to equalise the twofold forces of electricity. No one doubts that positive and negative electricity are each equal in power of "attraction and repulsion, identical in nature though opposite in the direction of their manifestation of the same intensity, and regulated by perfectly analogous laws;" yet it is found impossible, under apparently equal circumstances, to obtain sparks, or the other characteristic effects of electricity, of equal intensity from both poles of the same machine. A similar difficulty exists in devising an apparatus which will enable us to demonstrate an evolution of cold from expanding air, equal to the heat set free by the condensation of the same quantity of air to the same density. No instrument hitherto made, has been found capable of rendering them equivalents; and experimenters, who have no doubt of the actual equality, have regarded its construction as an impossibility. Machines on the plan of Professor Smyth's, though powerful elaborators of heat, are so far from producing this equality, that they do not render any of the cold of expansion apparent. Indeed, attempts to attain this great object have been so uniformly unsuccessful, that some philosophers have expressed doubts whether the equality really exists; and beautiful hypotheses have been constructed to account for the supposed natural inequality, and even an undefined agency of electricity has been assumed as affording the requisite explanation. This difficulty, however, it is easy to show, is owing to the inadequacy or imperfection of the means employed, and not to any deviation of the calorific forces of condensing and expanding air from universal natural law.

Experiment shows that there are insuperable, though, if properly managed, inconsiderable practical obstacles in every artificial device, to our obtaining all the cold which theory predicts as due from the expansion of a given quantity of air. Mechanical friction, for instance, as a source of heat, must operate as one of these obstacles in every contrivance of which we can conceive. But independent of this and similar difficulties, there are laws of elastic fluids which render a very peculiar apparatus necessary to enable us to produce, from their expansion, a quantity of cold approximating to the quantity of heat set free by their condensation. A thorough knowledge of these laws, and an ability to devise accurately the apparatus through which they may be applied, is indispensable to enable us to manufacture ice, cool rooms, or produce refrigeration in any way by the expansion of atmospheric air. No partial acquaintance with the former will be sufficient to obviate the difficulties which they have hitherto presented, in all attempts to render the principle of aerial expansion profitable; and the latter must be constructed upon a plan, not only not identical with Professor Smyth's, but as different from it as it is possible for one machine to be from another professing to have the same object in view.

* Not water. It is necessary, in order to make ice, that it should be a liquid uncongealable at the freezing point of water.

The laws referred to are founded on the relation of caloric to air as an elastic fluid. As their precise character and theory of operation are manifestly not understood, nor apparently suspected, by Professor Smyth, and, so far as my knowledge extends, have not been noticed by any other person, I deem it proper to offer the explanation of them, which many experiments with air, and much reflection upon its properties, have enabled me to make.

The most important of these laws is, that the expansion of air in an elastic medium does not produce apparent cold. A variety of circumstances enter into a consideration of the causes of this apparent anomaly. It may be partly owing to an ocular deception in regard to the position of the thermometer used to measure the temperature; for the mechanical force of escaping air, even under moderate degrees of tension, is so great, that it is impossible to keep a thermometer in its current, and any other situation, however close, subjects it to the influence of the general atmosphere. Where a steady tension is not maintained in the containing vessel, the absence of any apparent cold in the escaping air may depend, to some extent, upon a diminution, whereby the air is enabled to withdraw the caloric due to that diminution from the walls of the vessel, and from the remainder of the air. Friction from the attrition of air in passing through apertures is a cause of heat, and no doubt operates, where it is allowed to exist, to neutralize some of the cold generated by its expansion. Again, air, though one of the most perfect of fluids, is endued with inertia, and though its particles move very freely among themselves, yet they cannot yield as fast as air escaping under pressure advances, and therefore they must undergo compression, and consequently evolve heat.

All these causes, it must be admitted, are somewhat doubtful, and certainly trivial. But there remains one which, in itself, is sufficient, or nearly sufficient, to prevent a diminution of sensible temperature in an elastic fluid escaping from compression into the atmosphere. It is known from experiments on ventilation, and various modes of producing draughts of air through furnaces, that if a gas or vapour be forced, under any pressure, into the atmosphere, it will immediately, on issuing, change its form from a stream of uniform diameter into a cone. This change arises partly from its inherent principle of expansion, and partly from its being forced outwards by the resistance of the air against which it impinges, but more from enlargement of its bulk by admixture with other air. To complete the whole operation, the violence of the rush causes a vacuum, or partial vacuum, around the outline of the cone, which is immediately filled up by the mechanical pressure of the surrounding atmospheric ocean. From the operation of these causes, the expansion of the cone and mixture with the atmosphere are greater, in proportion as the force with which the air is propelled is increased; but in any case, a much larger quantity of air than its own bulk is blended with it in its course, and, in consequence, the whole assumes the mean temperature of the mixture. This temperature is always so nearly that of the atmosphere, that it is seldom distinguished by the thermometer.

The singular fact, that a gas or vapour at any temperature, in issuing from confinement into the atmosphere, tends to, or actually assumes, the temperature of the atmosphere, is not wholly unknown to, or wholly unexplained by men of science. In regard to vapours, it is familiarly known in the effect on sensation presented by the escape of high-pressure steam. Gay-Lussac, in speaking of the phenomenon in connection with the subject before us, said, many years ago, that "a current of air issuing from an orifice into the external air, under any pressure, does not show a diminution of temperature, although it dilates in issuing from the containing vessel." And Dr. Young, in the latter part of the last century, called the attention of men of science to it as a general law of elastic fluids; and he illustrated it by showing that a stream of smoke, coloured gas or vapour, issuing gradually into the atmosphere, penetrates farther in an unbroken column, than one issuing with violence. In the first case, the fluid seems to retain the form in which it issues by its attraction for its own particles; but in the latter, the mechanical power of expansion is superior to any molecular action, and the elastic fluids become immediately mixed from the violent action and reaction which take place. As this forcible admixture with the surrounding atmosphere, and the play of chemical and mechanical affinities, take place as fast as the emitted air assumes the volume due to the pressure of the atmosphere, the heat absorbed, however great may be the pressure producing the blast, and, consequently, however great may have been the quantity of heat expelled from it, instantaneously and exactly, or nearly exactly, compensates the cold arising from dilation. The causes of this apparent annihilation of the cooling action of expanding air may be more readily understood, if we consider that it escapes under a pressure of two atmospheres, with a velocity of fourteen hundred feet a second; of four atmospheres, of seventeen hundred feet a second; and of eight atmospheres, of nearly two thousand feet a second.

Notwithstanding some deceptive appearances, the causes of which I shall presently explain, it must be evident, from the foregoing considerations, that the escape of air, under any pressure, into a room, would not lower its temperature an appreciable particle. However difficult it may be to arrive at such a conclusion, *a priori*, every experiment affords a corroboration of its correctness, whose strength it is impossible to resist. Even the experiment which Professor Smyth adduces as the basis of his supposed invention, is a full confirmation of the correctness of this view. He says (vol. iii. page 157, *Practical Mechanic's Journal*), that the condensation of air under the pressure of one-fourth of an atmosphere. raised its temperature from 63° F.—the temperature of the atmosphere—to 92° F., and that its escape sank it to 63° F.—also the temperature of the atmosphere; and he regards these facts as evidence, that air escaping into the atmosphere under that pressure produced 29° F. of cold. It is surprising he could not see that the escaping air simply assumed the temperature of the atmosphere; and equally strange that the thought he has manifestly employed on the subject, could not enable him to understand that its temperature must inevitably be the same, whether it issued under the pressure of a quarter of an atmosphere, or of ten atmospheres; whether under an increase of temperature of 29° F. or 500° F.; and that the result would not be altered if this heat were previously extinguished. Logically as Professor Smyth defends his simple contrivance, it would be as unreasonable to expect that the escape of any quantity of air which its agency could condense should affect the temperature of a room, as to look for an appreciable increase of temperature from projecting the boiling contents of a tea-kettle into a river, or even into the Atlantic ocean.

But I have mentioned that there are some deceptive appearances accompanying the expansion of air in the atmosphere, and have promised to explain them. Many artificial phenomena, such as the occasional lowering of the indications of a thermometer, or the formation of a particle of ice, have been observed by experimenters as accompaniments of a jet of air, and their cause has been assigned to the principle of expansion. The Chemnitz fountain, so long known in connection with the practicability of producing ice, by allowing air to escape suddenly, is looked upon by philosophers as owing its power to the expansion of the air it had previously condensed. The experiment of M. Boutigny, which seems to have excited the wonder and admiration of the scientific world, by which water was frozen in a red-hot crucible, is effected by, or in connection with, the sudden rarefaction of a gas—sulphurous acid—previously condensed to the liquid form. The most intense refrigerative effect heretofore known, that of the production of solid carbonic acid from the gas of the same substance liquefied by pressure, has also been attributed to the absorption of heat produced by the simple principle of expansion. But in all these instances the cold is not referable to the expansion of the air or gas, but to the principle of evaporation called into energetic action by the previous condensation, and the presence of a liquid.

Evaporation is an obvious source of refrigeration, existing on an immense scale as a natural operation, and exerting a material influence in moderating what would otherwise be, in tropical climates, an excessive and unbearable atmospheric temperature. On account of its simplicity, cheapness, and facility of application, it is the most accessible of artificial refrigerants, and the one most generally resorted to in every stage of civilization. Producible from every liquid, and embodying in its vaporous constitution an immense quantity of caloric, which it rapidly absorbs from the atmosphere and all surrounding bodies, it may be readily applied as a means of lessening the temperature of a large space, or a great quantity of matter. Operating naturally, the intensity of cold it is capable of producing, depends chiefly upon the temperature, dryness, and velocity of motion of the atmosphere, and, under the most favourable circumstances, is insignificant. Artificially, its cooling force may be accelerated by the fan, and, as I have already taken occasion to intimate, the energy of the process may be powerfully increased by rarefaction. This increased effect is dependent upon the natural law, that the capacity for vapour of a given space—whether that space be a vacuum, or filled with air or gas of any density—is always the same for the same temperature. If, therefore, air be condensed into one-half, one-fourth, or one-eighth of its ordinary volume, it will have its capacity for retaining a liquid in solution, the temperature remaining the same, diminished to one-half, one-fourth, one-eighth of its previous capacity, and consequently, if before saturated, it will precipitate one-half, three-fourths, or seven-eighths of its liquid. Now, if the same air be allowed to escape into the atmosphere, its volume, with its capacity for vapour, will be increased two, four, or eight times, and it will be in a condition to support an evaporation, and to produce a reduction of temperature, two, four, or eight times as vigorous as it possessed in its condensed state.

Evaporation being in expanding air so energetic a principle, it is easy to understand how, in connection with a liquid, it may be productive of intense cold. The phenomenon is illustrated in the oft-quoted fountain of Hero, at Chemnitz, which, "during its play, compresses air to one-eighth of its ordinary volume, and on its being suddenly released, by turning a cock, expands," and consequently has its evaporative power so increased, that it is enabled "to cause the moisture driven out with it to appear, even in summer, as a shower of snow." Upon the principle of evaporation alone depends the cold produced in the magical experiment of M. Boutigny, and in that by which solid carbonic acid is obtained: in both cases, a gas, condensed under a force of many atmospheres into a liquid, is allowed to manifest its enormously increased evaporative power by an escape into the atmosphere; and in the one case, water in contact with the gas, and in the other a part of its own substance, is congealed by being robbed of its combined heat by the vaporising portion. Upon this property of air, and not upon expansion, depends any power Professor Smyth's machine, and all other similar contrivances possess of generating cold. It is therefore obvious that the Professor is in error, in supposing (*P. M. Journal*, vol. iii. p. 195) that the advantage of his scheme is in proportion as the air is used at a low compression. Such a principle, applied to the construction of machinery, though true within certain limits for simple expansion, as will be presently rendered apparent, is the reverse of advantageous where the result is the mere effect of evaporation; and Professor Smyth would find on trial, that his machine would be little superior as a refrigerator, over the wet mats which he describes as being used so inefficiently in the East.*

But though much error in regard to the relations of air to caloric, and particularly in confounding the effects of evaporation with those of expansion, has been committed—and the subject is certainly set around with many difficulties—it is not the less indisputable that the reduction of temperature from its expansion is precisely equal to the heat evolved by its condensation. In virtue of this immutable truth, I base its value as a source of artificial cold; and with the full reliance on the practicability of making it manifest, easily and profitably, which experiment has given, I have constructed the device which I offer to the world.

Natural and artificial phenomena have been long known, which prove that every increase in the volume of a gas or vapour is accompanied by an absorption of heat, or an evolution of cold. On this effect of expansion, we are enabled to understand the cause of the long-observed prevalence of snow on the tops of mountains, and the other evidences of intense cold which exist in the upper regions of the atmosphere. In experiments of the chemical laboratory, we find that, by allowing a comparatively small quantity of air to dilate suddenly, the watery vapour which is commonly diffused through it, may be converted into ice or snow. "Coal gas, which is a solution of carbon in hydrogen, if first condensed to expel heat, and then allowed suddenly to expand, will be so cooled, that the carbon will be separated like a black cloud," as snow is separated in the preceding case.

These experiments show that the dilatation of atmospheric air, or a gas, is attended with a very considerable diminution of temperature; but as they afford no precise measure of the change, other attempts have been made to determine the quantity of heat absorbed by rarefying air. Thus Dalton found, in an experiment with the common air-pump, that if a volume of air be suddenly doubled by expansion, its temperature falls 50° F. According to some experiments of Leslie, conducted upon a somewhat different plan, it would appear that atmospheric air, rarefied until its density was three-fifths of its natural density, when suddenly restored, acquired about 48° F. of temperature. Espy, of Washington city, states, as the result of experiment, that air expanding to half its density, or double its volume, generates a cold of about 90° F. The inference that Professor Smyth draws from his own experiment is, that the heat absorbed by every diminution of the density of air to one-half, or for every time its volume is doubled, is 120° F. These varying con-

* The comparative refrigerative advantages of evaporation and expansion may be illustrated as follows:—It is well known that the utmost affinity, or evaporative power for water, of a cubic foot of dry air at 32° F., is only about two and a half grains; or, in other words, this is the utmost quantity of ice that the evaporation by a cubic foot of dry air could produce. But I assert, as the result of a multitude of experiments, that the expansion of half a cubic foot of atmospheric air, at a density of two atmospheres, or to a cubic foot at the tension of the atmosphere, will absorb heat enough from a pound of water, to cool it 5° F., or will convert (1 lb. = 7000 grains × 5° ÷ 140°, latent heat of water, =) 250 grains of water at 32° F. into ice. It is, therefore, susceptible of easy proof, that the capacity of a machine to make ice, which avails itself of the full refrigerative power of expanding air, is, *cœteris paribus*, at least one hundred times greater than one that admits only the principle of evaporation. Further, refrigeration by evaporation rejects the application of the mechanical force of expanding air, while the principle of expansion renders it indispensable; and as the utilization of this source of power admits of the possible recovery of nine-tenths of what would be otherwise consumed, it will be evident that the latter principle admits of one hundred times the refrigerative effect being produced by one-tenth of the power required by evaporation; or, in other words, the relative values of my and Professor Smyth's schemes are as a thousand to one.

clusions in the bands of different experimenters, show that little is known on the subject that can be confidently relied upon. It has generally been considered that the quantity of heat absorbed by expansion is identical with the quantity of heat disengaged by condensation; and the numerical estimate of the former has always erred with the errors in making the latter deductions or experiments.

I must contend, as a deduction from numerous experiments—conducted upon a plan, not simply less liable to error than any of the methods by the foregoing experimenters, but from the transfer of cold to water, or the actual production of ice, incapable of an exaggerated error—that an expansion of air from a tension of two atmospheres to one, absorbs from water a quantity of heat equivalent to cooling itself 280° F. The quantity of cold thus obtained is materially different from any assigned by my co-labourers in this task. The numerical amount, though very much greater than that inferred from the obviously imperfect processes employed by many distinguished physicists, and the deductions of profound mathematicians, is yet less than the quantity of heat assigned to a similar degree of condensation by M. Gay-Lussac. As that able man conducted experiments on a more extensive scale, and on a plan less liable to error than those of any one except myself, whose experiments I have heard of, I have in his conclusions, independent of other and stronger considerations, the fullest confidence that I cannot have exaggerated the result.—I shall conclude the subject in a succeeding paper.

Apalachicola, Florida, August, 1852.

ON OBLIQUE OR TWISTED DRIVING BANDS.

The application of bands, or belts, to convey motion between non-parallel axes, is one of the many modern improvements in mill-work. The problem is by no means self-evident, and frequently gives considerable trouble to those who only know that it is possible, but have not got firm or full hold of the principle. The rationale is, however, easily comprehended, and admits of very brief explanation.

Let us consider, in the first place, the principle of the direct and open belt. In this case the axes are parallel, and the pulleys, or drums, are commonly cylindrical. The belt has no tendency to change its position laterally, for there is no reason why it should shift to one side rather than the other. But if one of the cylindrical pulleys is replaced by one slightly tapered—which sometimes happens unintentionally—the belt is observed to advance gradually towards the base, and not towards the apex of the conical drum, as might at first sight be expected. The reason is, simply, that the edge of the belt nearest the base is tightest, and is wound up more rapidly than the other edge, on account of the greater diameter of that end of the cone—exactly as in winding a band of paper, or the like, on a roller which is somewhat larger at one end than it is at the other; the paper advances, or *draws* towards the larger end. So it is with the belt: it advances towards the side of the greater diameter, precisely as if it were wound or lapped continuously round the drum, and with proportionally greater rapidity as the taper of the cone is greater.

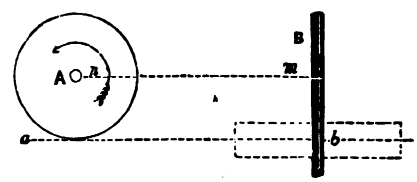
Advantage is frequently taken of this tendency of the belt to advance upon the larger diameter of a pulley, to form the pulleys somewhat convex at the middle of their width—as if composed each of two portions of cones joined at their bases. In consequence of this convexity—usually very slight—the belt keeps its place much more certainly than when the pulleys are plain cylinders. It has then, as we see, a decided tendency to remain on the pulleys, and it can have none whatever to run off. With this simple provision, belts are found, indeed, to keep their places on the pulleys, even when subjected to very considerable vibratory oscillations on account of inequalities of the belt itself—as irregularity of stretch, and imperfect joinings. Advantage is also especially taken of this curious property in the case of guide-pulleys, which are commonly very much *rounded* on this breadth; and also, when the axes are in different planes and not parallel, which is the only case we propose meantime to consider.

The circumstance, however, which makes oblique or twisted belts possible, is the following:—When a belt is to be shifted during motion to a new position on the drum or pulley it is driving, or from one to another of two equal and contiguous pulleys—fast and loose usually—it is necessary to apply the lateral pressure on the *advancing side* of the belt; that is to say, on the side of the belt which is approaching or running towards the pulley, and not on the *retiring side*, or that side which is travelling from, or is running off the pulley. If applied on the advancing side, a very small amount of pressure is sufficient to shift the belt; but an equal, or much greater amount of pressure applied on the retiring side produces no change on its position. No effect is, indeed, produced by displacing the side of the belt very considerably out of the plane of rotation of the pulley *from* which it is travelling; but the effect of a very small displacement from the plane of the pulley *to* which it is approaching is immediate.

From this it is not difficult to infer, that in order that a belt may maintain its position, it is only necessary that its advancing side should lie in the plane of rotation of that section of the pulley upon which it is required to remain, without regard to the retiring side, which may be deviated from that plane without in any way affecting the working of the belt. The correctness of this inference is corroborated by ample experience; and, as already intimated, it is that on which the contrivance of twisted belts fundamentally depends.

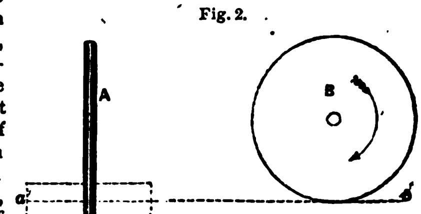
Let us suppose that A and B denote the positions of two shafts situated at right angles to each other—A, vertical, and B, horizontal—so that a line, $m\,n$, perpendicular to the direction of one axis, shall also be perpendicular to the direction of the other; and let it be required to connect them by a pair of pulleys and an endless band in such a way, that their directions of motion shall be those indicated by the arrows in figs. 1 and 2, and their velocities, 3 of A, to 2 of B. On A, as centre, let us describe the circle of the pulley we propose to employ on that shaft; then a tangent, $a\,b$, drawn to the circumference of that pulley, and perpendicular to the axis, B, and therefore parallel to the line, $m\,n$, determines the plane in which the side of the belt retiring from A towards B must travel. For the plane of rotation of the pulley on B, is necessarily perpendicular to its axis of motion; and the belt must be delivered by the pulley on A, into that plane, namely, the plane of rotation of that pulley. The position of this last is accordingly indicated (in plan) by the dotted outline in fig. 1; bisected in breadth, of course, by the tangent plane, $a\,b$, and limited in diameter by the relative velocities of the two axes.

Fig. 1.



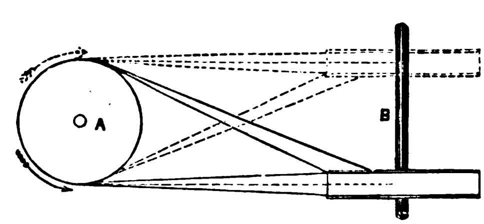
In this way the position of the pulley on the axis, B, is determined; but it still remains to determine the position of the pulley on the axis, A. This is done, however, in precisely the same manner. Thus, let fig. 2 be another view of the arrangement taken at right angles to fig. 1 above; and let the axis, B, have the direction of motion indicated by the arrow; then the circle of the pulley being described, and a tangent, $a'\,b'$, drawn to it, perpendicular to the axis, B, as before, we have determined, likewise, the situation of the pulley on the axis, A.

Fig. 2.



The positions of the two pulleys are thus fixed in such a way, that the belt is always delivered by the pulley it is receding from into the plane of rotation of the pulley towards which it is approaching, which is the one necessary and sufficient condition indicated above.

Fig. 3.

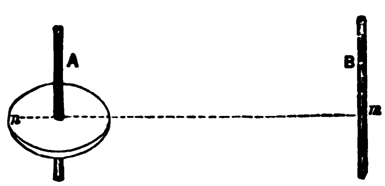


It is easy to perceive, that if, in this arrangement, the motion be reversed, the belt will immediately fall off the pulleys; for the required and essentially necessary condition, that the belt shall always be in the plane of rotation of the pulley which it is approaching, is then no longer fulfilled; the belt approaches the pulley obliquely, in a path which makes an angle, more or less considerable, with the plane of rotation; and tending to run straight, it necessarily falls off. The direction of motion cannot, therefore, be overlooked; but must previously be settled and taken into account in fixing the positions of the pulleys on their shafts. This is abundantly plain from what precedes, and is further illustrated by the cut, fig. 3, which shows the change of position of

the pulley on B, when the direction of motion of the axis, A, is reversed —the full lines of the figure correspond, of course, to the direction of motion denoted by the full-line arrow; and the dotted position of the pulley on B, to the direction of motion indicated by the dotted arrow. The same change takes place in the position of the pulley on A, when the direction of the motion of the axis, B, is changed; but the single view is sufficient for illustrating both cases. We need not, therefore, repeat the figure.

In what precedes, we have, for the sake of simplicity of illustration, assumed the directions of the axes to be perpendicular to each other; but this is by no means an essentially necessary condition. The axes may be situated at any angle whatever to each other, from 0° to 90°, if only by turning them through the given angle, till their planes of direction coincide, the shafts are then parallel. In other words, the perpendicular drawn to one axis must necessarily be also a perpendicular to the other. If otherwise—if the perpendicular is not common to the two axes, recourse must be had to guide-pulleys, to conduct the belt. We may, indeed, regard the axes as primarily parallel, situated in parallel planes, and that one of them is moved *in its plane*, till it forms any angle of direction with the other up to 90°; or, supposing that the common perpendicular, *m n*, is a material line, forming a rigid connection of the axes, then either of them, as A, may be turned round that perpendicular as a positive axis to any extent whatever. The situations of the pulleys will obviously be determined, as already indicated, by tangents to their circumferences, perpendicular to the shaft towards which the belt is on that side required to travel; and both tangents will be parallel to the common perpendicular, *m n*.

Fig. 4.



It is, by some, objected to this mode of driving, that it tends to wear out the belts very quickly, on account of the twist thrown upon them. This evil is, however, sensibly felt, only when the distance between the pulleys is not sufficiently great; when the belt is very long the objection vanishes. The appearance of the belt in work is also sometimes a subject of remark with those unaccustomed to the arrangement; and no doubt it suggests a peculiar feeling of insecurity, as if the belt were always about to fall off the pulleys. There is, however, little more tendency of this than there is of the ordinary belt running off; and commonly, the retention of the belt is additionally secured by the pulleys being slightly *rounded* in the manner already noticed. The tendency of the belt is to run on the section of the largest diameter of the pulley, and this is at the middle of the breadth, and therefore in the planes of tangence to the two pulleys.

β.

THE SEAL FISHERY OF NEWFOUNDLAND, AND THE MODE OF PREPARING SEAL OIL.

The seal fishery of Newfoundland has now become the most important part of the trade of that colony; and although not so extensive a staple, nor so generally followed as the cod fishery, yet, when the capital and time employed, and the almost certain and immediate return for investment are taken into consideration, it is by far the most profitable part of the business of that colony, or perhaps of any other part of the British Empire.

A quarter of a century ago, there were only about 50 vessels, varying from 30 to 60 tons burthen, engaged in this branch of trade; but within that period it has been gradually increasing. In the year 1850, the outfit for this fishery from Newfoundland consisted of 229 vessels, of 20,581 tons, employing 7,919 men. The number of seals taken was 440,828; and according to the Custom-house returns for that year, the total value of skins and oil produced from the seal amounted to £298,796. In the present year, 1852, the outfit consisted of 367 vessels, of 35,760 tons, employing about 13,000 men; but the returns and value of the year's fishery have not yet been ascertained. Although it was a disastrous season, in respect to loss of vessels, yet the catch of seals upon the whole was above an average one, there being from half to three-quarters of a million seals captured.

The vessels engaged in this business are from 75 to 200 tons burthen. Those lately added to the sealing fleet, and which are now considered of the most suitable sizes, range from 130 to 160 tons. Vessels of this size carry from 40 to 50 men. The season of embarking for the voyage is from the 1st to the 15th of March. The voyage seldom exceeds two months, and is often performed in two or three weeks; and several vessels make two voyages in the season, and some perform the third voyage within the space of two months and a half.

The seals frequenting the coast of Newfoundland are supposed to whelp their young in the months of January and February; this they do upon pans and fields of ice, on the coast, and to the northward of Labrador. This ice, or the whelping ice as it is termed, from the currents, and prevailing northerly and north-east winds, trends towards the east and north-east coast of Newfoundland, and is always to be found on some part of the coast after the middle of March, before which time the young seals are too young to be profitable. The young seal does not take to the water until it is three months old. They are often discovered in such numbers within a day's sail of the port, that three or four days will suffice to load a vessel with the *pelts*, which consist of the skin and fat attached, this being taken off while the animal is warm; the carcase, being of no value, is left on the ice. The young seals are accompanied by the old ones, which take to the water on the approach of danger. When the ice is jammed, and there is no open water, large numbers of the old seals are shot. The young seals are easily captured; they offer no resistance, and a slight stroke of a bat on the head readily despatches them. When the pelts are taken on board, sufficient time is allowed for them to cool on deck; and they are then stowed away in bulk in the hold, and in this state they reach the market at St. John's, and other ports in the island. Five-sevenths of the whole catch reach the St. John's market. A thousand seals are considered as a remunerating number; but the majority of the vessels return with upwards of 3,000, many with 5 and 6,000, and some with as many as 7, 8, and 9,000. Seals were formerly sold by tale; they are now all sold by weight,—that is, so much per cwt. for fat and skin.

The principal species captured are the hood and harp seal. The bulk of the catch consists of the young hood and harp in nearly equal proportions. The best and most productive seal taken is the young harp. There are generally four different qualities in a cargo of seals,—namely, the young harp, young hood, old harp and bedlamer (the latter is the year old hood), and the old hood. There is a difference of two shillings per cwt. in the value of each denomination.

The first operation after landing and weighing, is the skinning, or separating the fat from the skin; this is speedily done, for an expert skinner will skin from 300 to 400 young pelts in a day. After being dry-salted in bulk for about a month, the skins are sufficiently cured for shipment, the chief market for them being Great Britain. The fat is then cut up, and put into the seal-vats.

The seal-vat consists of what are termed the crib and pan. The crib is a strong wooden erection, from twenty to thirty feet square, and twenty to twenty-five feet in height. It is firmly secured with iron clamps, and the interstices between the upright posts are filled in with small round poles. It has a strong timber floor, capable of sustaining 300 or 400 tons; and stands in a strong wooden pan, three or four feet larger than the square of the crib, so as to catch all the drippings. This pan is about three feet deep, and tightly caulked; and a small quantity of water is kept on its bottom, for the double purpose of saving the oil in case of a leak, and for purifying it from the blood and any other animal matter of superior gravity. The oil made by this process is all cold-drawn; no artificial heat is applied in any way, which accounts for the unpleasant smell of seal oil. When the vats begin to run, the oil drops from the crib upon the water in the pan; and as it accumulates it is casked off, and ready for shipment. The first running, which is caused by compression from its own weight, begins about the 10th of May, and will continue to yield what is termed *pale seal oil* from two to three months, until from 50 to 70 per cent. of the quantity is drawn off, according to the season, or in proportion to the quantity of old seal fat being put into the vats. From being tougher, this is not acted upon by compression, nor does it yield its oil until decomposition takes place; and hence it does not, by this process, produce pale seal oil. The first drawings from the vats are much freer from smell than the latter. As decomposition takes place, the colour changes to straw, becoming every day, as the season advances, darker and darker, and smelling worse and worse, until it finally runs brown oil. As this running slackens, it then becomes necessary to turn over what remains in the vats. The crib being generally divided into nine apartments or pounds, this operation is performed by first emptying one of the pounds, and dispersing the contents over the others, and then filling and emptying them alternately until the entire residue, by this time a complete mass of putrefaction, is turned over. By this process a further running of brown oil is obtained. The remains are then finally boiled out in large iron pots, which, during the whole season, are kept in pretty constant requisition for boiling out

ADJUSTABLE COAL-SCREEN.

T. Y. HALL ESQ. PATENTEE

Newcastle-on-Tyne.

the cuttings and clippings of the skinning and other parts of the pelts, which it is not found advisable to put into the vats. The produce of this, and the remains of the vats, are what is termed the boiled seal oil. These operations occupy about six months, and terminate towards the end of September.

During the months of July, August, and September, the smell and effluvia from the vats and boiling operation are almost insufferable. The healthy situation of St. John's, from its proximity to the sea, and the high and frequent local winds, is doubtless the cause of preventing much sickness at this season of the year. I have never known any disease or epidemic attributable to such a cause; and the men more immediately employed about the seal-vats have a healthy and vigorous appearance.

Some improvement has taken place since the great fire of 1846, when all the seal-vats in the town were destroyed. Many of the manufacturers have erected their new vats on the south or opposite side of the harbour; but there still remain sufficient vestiges of the seal trade, to cause a summer residence in the town of St. John's anything but desirable. Even the country, for several miles around St. John's, affords no protection from these horrible stenches. The animal remains from the vats, and the offal from the cod-fish, are found to be such a valuable manure, that they are readily purchased by the farmers in the neighbourhood; and from whatever quarter the wind blows, the pedestrian in his rural walk has little chance of breathing anything like a genial atmosphere.

After a year's residence in Newfoundland, I turned my attention to some mode of improving the manufacture of the seal oil. The result of several experiments upon the different qualities of seal's fat, satisfied me that the whole produce of the fishery, if taken while the material is fresh, as it generally arrives in the market, and subjected to a process of artificial heat, was capable of yielding, not only a uniform quality of oil, but of much better quality than the best prepared by the old process, and free from the unpleasant smell common to all seal oil. Subsequent experiments resulted in the invention of a steam apparatus for rendering seal and other oils, which has been found to answer an admirable purpose, and for which I have received letters patent under the Great Seal of the Island of Newfoundland.

The advantage of this process must be manifest, when it is understood that twelve hours suffice to render the oil, which, by the old process, requires about six months; that a uniform quality of oil is produced, superior to the best *pale* by the old process, and free from smell; that a considerable per centage is saved in the yield, and what is termed *pale seal*, produced from the old as well as from the young seal. Besides, if this process were universally adopted, the manufacturing season would cease by the 31st of May, and the community would be saved from the annoyance attending the old process.

The chief market for seal oil and skins has hitherto been Great Britain and Ireland; but a few cargoes occasionally go to the continental cities. This year, for the first time, a new market for seal oil has been opened in the United States, owing to the greatly increased consumption of oil in that country, together with the failure of their whale fishery. Upwards of 2,000 tons of this year's produce have already been shipped to that country. The latter shipments, however, have not realised to the shippers the prices of the first, from the fact that, upon the trial of this oil, although it was found to be valuable for its combustible qualities, yet in a hot climate it was altogether unfit for domestic purposes, on account of its singularly offensive smell.

In the United States, the great consumption of oil is for domestic purposes; the chief cities only as yet being lighted with gas, and that but partially, from their constant increase. Candles, unless of the most expensive kind, will not suit that climate, particularly in the summer season; and hence oil and camphine, where gas is not used, are chiefly used. All animal oils used in that country, whether of sperm, right whales, or lard, are rendered by artificial heat, and are in consequence free from the unpleasant smell of our cold-drawn seal oil.

Samuel George Archibald.

St. John's, Newfoundland.

HALL'S ADJUSTABLE COAL SCREEN.

(*Illustrated by Plate* 110.)

This "screen," which is the invention of T. Y. Hall, Esq., of Newcastle-on-Tyne, is contrived for the purpose of separating various sizes of coal at pleasure, in the same machine; so that the colliery owner may thus meet the demands of different localities, or the requirements of various purposes of consumption, without the necessity of encumbering his works with a great range of the common fixed bar screens. The system of parallel adjustment of the bars, resembles that adopted in Mr. Jamieson's ingenious "zig-zag expanding and contracting wraith,"* of the cotton manufacture, the screens being connected to a system of jointed zig-zag levers, the greater or less angularity of which defines the proportionate width of the screening spaces.

Fig. 1 is a vertical sectional side elevation of the particular form of screen which Mr. Hall has decided upon as the simplest and best suited for his purpose. Fig. 2 is a plan of the screen, showing the bars both in the expanded and collapsed state. Fig. 3 is a transverse section of the screening bars, as set with ⅜ inch spaces; whilst fig. 4 represents them expanded to their full extent, or to 1½ inch spaces. The main frame, A, is of timber, of the usual construction, the two vertical sides being connected transversely by wrought-iron stay-rods, B. Along the centre of the screen is a square bar, C, with a nut at each end, by which it is bolted into the two end transverse pieces of timber, D; and this bar, C, answers to carry the fixed centre joints of the jointed zig-zag levers, E. In the present instance, there are five sets of these levers in the length of the screen, their fixed end joints being at F, whilst their free joints are similarly jointed to the long parallel side bars of T-iron, G, which, with the vertical plates, H, form the sides of the screen; and the opposite ends of the second halves of the jointed levers are connected to the fixed framing, A. The screen bars, J, have joint-pins attached to their under sides, at certain regular distances asunder, corresponding with holes similarly arranged in the zig-zag levers. The setting and adjustment of the bars is accomplished by the winch-handle, K, fast on one end of the transverse right and left threaded screw-spindle, L, which is carried in end bearings in the timbers, A, working through the two nuts, M, attached one on each bottom side of the T-iron frame-pieces, G. Hence it is clear, that the revolution of the screw-spindle, L, in one direction, will traverse the nuts, M, towards the centre bar, C, whilst the reverse movement will expand and remove them further from the centre on each side. Thus the nuts carry with them the side bars, G, and these bars being set parallel with the screen bars, which are connected as we have shown with the levers, E, the screen bars are brought nearer together or further apart, as required, according to the varying angle of the zig-zag levers with the longitudinal centre line of the screen. The ends of the screen bars, at the top of the incline, work beneath the framework, and at the bottom they work on the upper side of a plate, on which the coals are delivered from the screen, the smaller particles having passed through the bars; and in the arrangement which we have illustrated, these small particles are again screened by a sheet of wire-gauze, N, contrived to separate the dust, or duff, from what has passed through the regulating screen. Each division has a shoot, O P, to deliver the coals and dust into separate waggons beneath.

Instead of the wire-gauze, a second regulating screen may be used, when two sizes of large coal are required; or the top screen may be divided into two lengths, and each portion made and worked independently of the other, so that each may screen a distinct size. Besides their facilities for screening any size of coal within defined limits, the attendant is enabled to screw the bars hard up into close contact, so as to form a "dumb screen," or shoot, when the coals are merely to be discharged without screening.

As a coal owner, and practical colliery viewer, Mr. Hall has been induced to adopt this plan of screen by his daily experience of the inconvenient defects of the old form. The improvement may be adopted either in the form of a fixed or portable machine, at railway coal depots. The portable screens, for example, may be used for discharging coals from ships into barges or lighters, or for use where they are only temporarily required. In situations where mechanical power is available, and where the height or amount of inclination is limited, Mr. Hall gives the screen a lateral movement, technically known as a "shake," in order to assist the screening action. When so arranged, the screens are either hung on links, or placed in vibrating supports, so that the coals may be efficiently screened with a comparatively slight amount of inclination. The plan, all throughout, possesses the great merit of simplicity, whilst the conveniences which it offers are palpably obvious.

The same plate exhibits Mr. M'Connell's recent important improvements in permanent way, with continuous longitudinal timber bearings. The timber sleepers are triangular in cross section, their flat base resting on the ballast, whilst the upper rectangular ridge forms the bearing surface for the rails, which are rolled with a corresponding angular base. Nothing can afford a more satisfactory hold for the rails upon the sleepers, than this arrangement.

* Page 37, P. M. Journal for May last.

ON RAISING WATER FOR THE PURPOSE OF IRRIGATION IN THE COLONIES.

By Professor C. Piazzi Smyth.

Throughout our extensive colonies in the south, the Cape, New South Wales, New Zealand, &c., the want of water is one of the greatest impediments to the progress, not only of agriculture, but also of civilization. In a country where water is regarded "as so precious a fluid, that none of it is wasted in washing," neither cleanliness, nor godliness, nor industry, nor intellect, can be expected to flourish, any more than the crops of the agriculturist, or the fields of the grazier. In such a place, the population must necessarily be scanty and barbarous.

Parts only of these colonies are so very bad as this, but often large parts; and the average of the whole is so decidedly under-supplied with water, that if some steps be not taken to remedy this natural defect, the inhabitants must ever be few and far between. Dependent, too, in their farming operations, rather on feeding their animals upon the natural products of the country, than on raising food for them by methods necessitating some industry and forethought, they must inevitably approach the uneducated state of nomadic tribes. For though the chance discovery of gold may suddenly bring great numbers of persons to one spot, that is but a temporary diversion of the labour of a new country, which must be farming of some sort; while, if so great a crowd be congregated for a time in any one region, it is all the more important that it should be enabled to produce the staff of life in the greatest possible quantity.

The warmth of the climate of those colonies is such, that water is almost the only requisite for fertilizing the fields, and for producing an almost unlimited growth, no matter what the soil may be, so long as there is abundance of water. But without that necessary solvent, the earth is too hard to be penetrated by the plough, and no tender plant can retain its life under the scorching rays of a vertical sun. That sun, which is the essence of growth where water is present, is the breath of destruction when moisture is absent, and the country becomes a desert.

There is something really inimical to the Anglo-Saxon in a dry country; he must have water, and plenty of it, for his food, for his comfort, for his machinery. He has abundance in his native country, and abundance, water power incalculable, in North America, where, of all his attempts at colonization, he has succeeded best; where he has struck root into the country strongest, and given evidence, while producing a decided variety from the parent stock, that he is not degenerating. But in these new southern colonies, the Anglo-Saxon is about as much at home as a Newfoundland dog would be in the deserts of Arabia, or an elm tree in the Sahara: it might live, but would certainly become contracted from its noble proportions. So long as vacant land existed in America, covered with forests, and abounding with rivers, it seems a mistake to have sent Englishmen to toil on the treeless wastes and arid plains of South Africa and Australia. However, there they are now; and the gold of the latter region is likely to influence the destiny of many. It remains, therefore, only for those who can safely and impartially, from a distance, see and judge of the deteriorating effects on civilization, which must always follow, more or less, whatever be the race or tribe of man, from a country being hot and dry, and unable to sustain any but a very scanty population,—to endeavour to devise a remedy.

Such, as described above, is the actual state of the greater part of our colonies, and such, too, is the present condition of many portions of the Old World in similar latitudes, though it was not always so. The land of Shinar, for instance, is now but an arid tract, wandered over by a few barbarous herdsmen; and yet it was once the most populous and the most civilized country in the whole of the globe, resounding with the hum of busy multitudes, and exhibiting the highest arts and sciences and wealth of the world.

But *then* the waters of the rivers were led out of their beds, and made to course over the land far and wide in fertilizing streams; and these deserts could then easily furnish the food for those teeming multitudes.

Only travellers who have been in the East and the South can fully appreciate the effects of water; the ground may be, nay, generally is, of a colour most forbidding to English agricultural eyes. In place of a deep brown verging on black, it exhibits but a light ochry hue. But introduce water, and how the plants will grow!—what tons of produce may be taken off a few square yards of ground!

Such persons can fully understand the importance attached in the East to procuring supplies of water for the purpose of irrigation. Monarchs did not wait until their subjects compelled them to do something, but anxiously strove to effect all that their power could possibly compass; confident that the water could always be procured, if sufficient means to that end were employed. They knew that water being procured, the means of support, and the happiness of their subjects, would be thereby increased; while the name of the beneficent ruler would be carried down by a grateful people, through ages wherein the more powerful despots, and luxurious sovereigns, should be lost in oblivion.

No one, I believe, who has lived any time in those countries, and entered into their affairs, and felt with the people, and sympathised with their struggles in the battle of life, and tried to assist them in their contest with nature, but will agree, more or less, with these opinions. Accordingly we find, in the case of our East India Company, living to so great an extent as its members do in that immense empire which they rule, they have caught something of the better spirit of the region in times past, and have, in many instances, in various parts of the country, proved themselves worthy successors of the great potentates of old, in that which forms their truest glory, and the chief foundation of their yet existing popularity amongst the people.

But in the crown colonies, alas! the case is far different. The minister has never been in any of them, and knows little of their natural circumstances and social wants. He governs them by deputy, and on the same principles as the home country; proper enough there, but inapplicable to the colonies. At home, it may be very right for a minister to do only that which is pressed upon him by the people, and this only in the easy department of gathering the taxes; for safely may be left to the people of the mother country to find out what is good for themselves in politics and in business—they have a voice to insist on the one, and they have abundant pecuniary means to carry out the other; and they are fully as well educated as their rulers.

But in the colonies, the people are weak and few in number, scattered over an immense extent of territory; they are seldom of the best educated, or of the wealthy classes; and, more untoward still, they are not allowed to govern themselves. They are in the hands of the Colonial Secretary and his governors, to do with them as he pleases, almost unquestioned. If, then, he takes to himself the honours and privileges of a despotic ruler, he ought also to perform the duties of that situation. He ought not to be content with the mere taxing, and with the police regulations of the people lying under his power, but he should exert a fatherly care for them in all their interests, and in all their phases of life; he should study all their trades and professions, should understand them better than they do themselves; and ever be carrying into effect intelligent and far-seeing measures, for developing their sources of industry, and increasing all humanizing and civilizing tendencies amongst them. Unless he undertakes thus to be the father of the people he despotically governs, the minister omits the payment which he is morally bound to make in return for the honours and emoluments which he enjoys.

But, undertaking them, he would find in those hot, dry colonies, that nothing was so important as the supply of water to all classes, and through all the phases of their life. This would be found to be the first subject to occupy his attention. Nor would the task, in general, be so very difficult; for though water be not found at the times and in the places where it is wanted, it is yet to be had by a little trouble. Water there is, but the supply required for summer's use is allowed to flow off into the sea during winter, or to get down into such low beds, that it is useless for all practical purposes.

To procure water in general for irrigation, under these circumstances, one of three methods must be adopted, viz., either to lead it out of river courses by inclined channels, or to raise it out of the same by mechanical means, or to build dams across valleys, and so husband up the winter's supply of rain in artificial lakes. This last system, however, should be looked on as a last resource, for the quantity of water so to be procured must be limited, and more adapted to furnish drink for cattle, than the large quantity of fluid required for irrigation. It is, moreover, decidedly too much of an attempt to take the bull forcibly by the horns, and *to create* a supply of water, rather than the more advisable and economical plan of merely *directing* the natural supply into a more useful channel; though, doubtless, under some circumstances, it may be found advisable.

We may confine our attention, then, for the present, to the two methods of leading water out of a river channel from a higher level, or raising it up from a lower one by mechanical means.

Of these two, the former will always prove the more economical and powerful; and there are few places where it is not applicable, if we only go sufficiently far back along the course of the river to obtain the necessary fall. An admirable instance of this is afforded in the Great Ganges Canal, which the East India Company are at present forming, to their immortal honour. By retiring along the banks of that river, until they came to its point of escape from the hills, they have attained its waters at so high a level, as to be able to lead them out in a long canal, and convey them hundreds of miles over an apparently level and arid tract, converting what would have been a lifeless desert into a fertile garden, plentifully interspersed with populous villages.

When our colonial farmers live amongst the hills, they may easily

adopt this plan upon any of the little steep flowing streams around them. But when they are living in the plains, or in countries of larger features, where the rivers flow with a barely perceptible current, the work becomes one then of imposing magnitude. To obtain the requisite fall, the farmer must begin his operations so many miles higher up the stream than his own estate, that vast extents of probably unoccupied crown lands, in addition to numerous farms, are mingled up in the measure. In such a case, while so comprehensive a measure is only possible in those new and thinly-peopled countries to be accomplished by the government, it also becomes the minister's duty, as he does not allow the colonists to manage their own affairs; and he himself only knows what policy he may intend to carry out in the country; and for what time, and for what purposes, he may intend to retain it.

But will the absolute colonial ruler, with the assistance of his engineers and surveyors—will he carry out his bounden duty towards those whom he rules, in making dams, and sluices, and embankments, and bridges, and tunnels, and water-courses? If the minister at home, or the governors abroad, knew a little more about engineering matters, we believe that they would, for they do show a wish to do their duties. Occasionally, instead of the usual infantry-general appointed to a governorship (and surely the education of young officers of the line is not exactly that fitted to make them *au fait* at civil engineering), occasionally an engineer officer is sent out. As an instance, I remember seeing the late Captain Sir George Gipps, R.E., touching at the Cape on his passage to the government of New South Wales, and when he saw the Dutch farmers on the lower part of the valley of the Liesbeek River, puddling with wretched dams to raise out a small portion of the water to irrigate a little ground on either side of the stream; while broad and gently inclined slopes, from Table Mountain and Devil's Berg, above lay parched and dry, and the unused portion of the river was wasting its sweetness amongst the quicksands of the Salt River and Table Bay, —"Why," said he, "was not the water taken out higher up the bed of the river, and led over all those slopes?" Some one said, that some one's private property was in the way. "Then," returned he, "it should be bought up; no private interests should prevent so great a public benefit from being carried out." But still the waters were allowed to run on in their accustomed channel, and be almost wholly lost in the sea, at the very time that Cape Town was complaining of want of water, and had to procure the vegetable productions dependent on water by barbarous roads over rocky mountains. Some years afterwards, however, it is said, the colonial minister did stir himself to do something: he so far confessed the principles of his duties; and hearing that the great drawback on the colony was drought, he procured an account of the methods of water-managing in North Italy, and directed the governor, for the time being, to carry them into effect, as far as possible, at the Cape. Italy, like the Cape, was warmer than England, so anything suitable to the one must be proper to the other, and the word water was magical. But, alas! the instructions, on arrival, turned out to be from North Italy—from the range of low country at the foot of the Alps, and kept in a constant state of quagmire by the infiltrations of a thousand streams from a higher level, and by the mighty Po, flowing in a channel raised high above all the surrounding country; and where the water-managing required is an intricate system of ditches, to drain at least the upper surface of the ground, and leave the plants a foot or two in depth of ground not absolutely swimming in water. And yet this was the plan directed to be carried out to improve the burning deserts of the Cape!

Verily, there is a wide field open wherein a colonial governor may earn distinction in doing well for his people; and but the other day, another engineer officer acquired the name of "the good governor," from his attention to other than the mere legislative duties of his station. Colonel Sir W. Reid saw plainly, that however well it may answer at home to leave everything to the energy and intellect of the people, that such a theory does not answer for the colonies. He did not, therefore, think it beneath him to enter into the farming and gardening of the Bermudas, and the honour was reserved to him of introducing the most appropriate produce for the island. The poor inhabitants might lament that, although of all parts of the world their spot was the most congenial to the growth of oranges, yet they had no eatable ones. Centuries passed, and still the island bore only one kind of bitter fruit. This practical result showed that colonists cannot properly supply their own desiderata; and so it was reserved for "the good governor," within the last half dozen years, to introduce branches of the sweet orange, and therefrom bud the bitter ones, and so utilize the fruit of the island. A great industrial and statistical result, and yet how very easily might it have been accomplished at any time by those in power, with ships of war at their disposal, in times of peace!

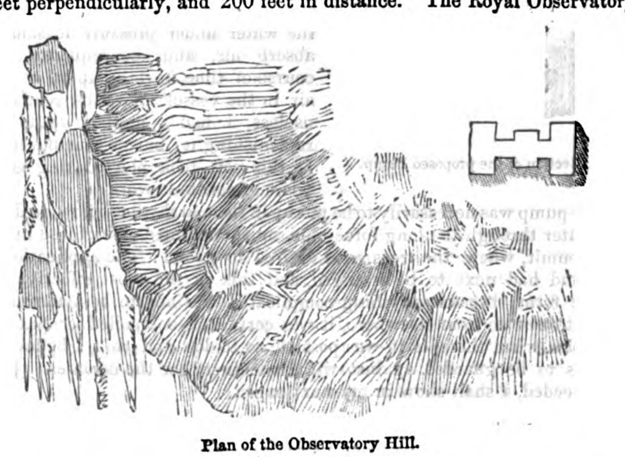
From the slow rate of improvement, however, in our colonial government, there is small chance of any of the large rivers being led out into irrigating canals in our time; and it is necessary to turn to the more necessitous, though less economical, method of lifting the water up from a lower level by mechanical means. This is a plan, too, by which a farmer can, at almost any time, and in any place, help himself; while it would also be most important that it should be occasionally taken up by government, not only because water-raising can be managed more cheaply on the large scale than on the small, but because it cannot be expected that the ordinary class of colonists, half buried in the wild-bush, are conversant with the best engineering knowledge of the home country, or in a position to profit by it if they were. The actual erection, therefore, of a water-raising machine in the land, would be found to do far more good, produce far more conviction, and lead to many more being put up, than all the lectures that could be delivered, or books that could be written; for it is only that which is actually seen and felt, that is fully understood and appreciated by such persons.

But the specimen machine must be sound in its principle, and well realized in practice, or more harm than good may be done; as, indeed, I remember, in the case of a worthy gentleman who, by his failures and blunders, completely convinced his ignorant neighbours that their notion was perfectly correct, viz., that it was impossible, and that it was sinful to try, to make water run anywhere, where it would not do so naturally. This person failed from an error very frequent, viz., having recourse to all manner of bucket-wheels, and clumsy hydraulic contrivances, because they were such as could be *made* on the spot. Let them be such as can be *repaired* on the spot, but let the more important parts be *made* by those more competent for such work than a small farmer in a trackless wilderness. Bows and arrows might be made on the spot, yet will the emigrant prefer a Birmingham gun as his means of defence or support. He will certainly kill more game with it, though he may not be able to make any of the essential parts of it. In truth, there is hardly a more important instance of the value of the division of labour, nor a case where more mutual assistance may be rendered, than by the mechanic at home supplying hydraulic machinery to the colonist; and he sending back in return the rich produce of the watered soil of a hot climate.

The necessary apparatus will always resolve itself into an engine for lifting the water, and some sort of mechanical force by which that engine is to be worked.

For the former, there is, after all, nothing like the pump—the simplest and the most effective of all hydraulic contrivances; while, for the motive power, the colonist will find the wind the cheapest force he can employ, but will probably have to assist it now and then with the strength of horses and oxen. There are so many ways of carrying out these principles in practice, that I may, perhaps, as well at once describe, as an example, a particular machine which I erected at the Cape, and then give a few hints as to how it may be varied to suit different localities.

The case to be met was to raise water to the top of a rocky hill, 30 feet perpendicularly, and 200 feet in distance. The Royal Observatory



Plan of the Observatory Hill.

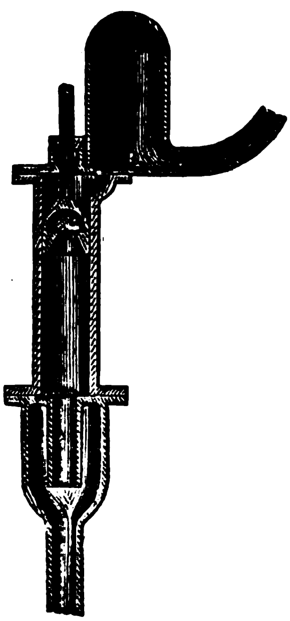
stood on the top of the hill, bare and dry, exposed to a hot sun and a fierce wind, blowing, too, almost invariably in the direction of the meridian, to the great detriment of many important observations of close south polar stars. "Why don't you get up a screen of oaks?" said a funny gentleman in the neighbourhood—oaks being there remarkably quick and luxuriously growing plants, and he living in a well-watered dell abounding with them. "Well, so I will." Oh, but then he and many of his neighbours began seriously to prove that the project was

madness; for, firstly, they said, "The hill is little more than a bare whinstone rock, and has not soil enough for the roots of any plant;" and, secondly, "It is as dry as a brick;" and, thirdly, "The wind is so violent that nothing can stand against its might." "Then, if the wind is so strong, it shall rain water to the top of the hill, and where water is, in so hot a climate, anything will grow." "Oh, but suppose that

Vertical Section of the Observatory Hill.

the wind leaves off, what will you do then?" "The plants will not die outright and at once, if they do not get their drink with perfect regularity every day; and the Meteorological Journal shows that they are not likely to be kept waiting in this country very long for want of wind." "Oh, we shall see!" "Yes, you shall see!"

My operations were necessarily on a small scale, as suited to the modest means of an assistant in the Observatory. My friends had sent me out from England, an ordinary house pump, of the *lifting and forcing* variety, of 3 inches bore, and 9 inches stroke, with 15 feet of $1\frac{1}{2}$ inch suction pipe, and 200 feet of $1\frac{1}{4}$ force pipe. To equalize the flow of water in the long tube, I added an air-vessel of 12 times the capacity of the cylinder above the exit valve; and it might have been as well if another, an exhausting air-vessel, had been applied at the entrance valve, in connection with the suction pipe, to equalize the flow there, and to deaden the jars of valves and fluid, which, at every change in the direction of the piston's motion, become extremely prejudicial when working at the great speed which sudden gusts of wind produced. The extra expense of these air-vessels will be found well repaid by the material saving which they will cause afterwards in wear and tear. Next, as the water under pressure is said to absorb air, and, consequently, in course of time, to take up all of the air in the vessel, and thus render it useless, I had a method ready for replenishing it; but no sensible effect of this sort took place during seven years of constant work.



A Section of the proposed Pump.

The pump was necessarily to be put up in the marshy flat below, to drive the water through the long force-pipe, up the inclined side of the hill to the summit, where the trees were desired to grow. The application of the wind had next to be arranged, and this in the most effective and simple form; because anything complicated was not to be made there, or if it came so from elsewhere, it was certain to be spoiled or put out of repair when there, if it was possible so to do; and this, I believe, is always to be guarded against with machinery for the colonies. How I succeeded, I shall show in my next paper.

SIEMENS' ROTATORY BALANCE WATER-METER TO WORK UNDER PRESSURE.

(*Illustrated by Plate* 111.)

The little instrument represented in two views in our plate 111, is the FULL SIZE of a fluid meter, capable of measuring something more than 800 gallons of water, or as much as is necessary for the condenser of a six horse steam-engine, per hour. It is the invention of Mr. Charles William Siemens of Birmingham, a brother of Mr. E. W. Siemens of Berlin, the inventor of the "Prussian State Telegraph,"* both of which gentlemen must be well known to the readers of this Journal, from their many valuable contributions to physical science and the constructive arts.

The "balance meter" is of the rotatory kind, and has been contrived with the view of securing, within the compass of extremely simple details, the power of registering the quantity of water flowing through a pipe, with equal accuracy at all pressures, and without in any way impeding the continuous flow from the supplying head. Fig. 1, on our plate 111, is a full-size longitudinal elevation of the meter, a portion of the indicating dial being broken away to show the internal indicating details. Fig. 2 is a corresponding longitudinal section of the meter, exhibiting both the rotatory measuring apparatus, and the index gearing. The whole of the apparatus is contained within the cylindrical cast-iron shell, A, having plain end flanges, B, for bolting it in the line of the water-supply pipe, and a short cylindrical box, C, screwed on the upper side to hold the index gearing. This shell is cast hollow and open throughout, but with three projecting annular ribs for boring out as a seat for a drawn brass lining tube, D, inserted for the purpose of securing a perfectly uniform area throughout the water way; and within this water way are placed two hollow metal drums, E, supported on longitudinal spindles, F, set in the axial line of the shell. These spindles are carried at their outer ends in bearings, G, in the centres of the fixed cone pieces, H, one of which is in section; and the opposite or inner spindle bearings, are in a single central bracket opposite the rib, I, of the shell. Each longitudinal half, from this centre line, is precisely the same in construction. The cones, H, have each projecting spindle pieces, passing to near each end of the shell, where they are steadied concentrically with the shell's axis, by cross bars, J, in shallow ring pieces recessed into each end of the shell; whilst the cones themselves are steadied by four thin radial blades, K, fitting to the brass lining. The inner surfaces of these cones are concave, and the slightly convex faces of the drums, E, project a little way into these concavities, as shown on the right side of the figure. The drums, E, are the prime motive details, each having a set of screw blades or twisted vanes, L, set in reverse directions, or right and left handed. Motion is conveyed from the drum spindles by pinions, M, one on the inner end of each spindle. Each pinion gears into two opposite crown wheels, N, so that the two drums are compelled to revolve at the same rate in opposite directions. The lower crown wheel is simply carried on a short stud-shaft, running in bearings in the centre bracket, being merely used to connect the two pinions on the lower side; whilst the upper wheel is fast on the lower end of a prolonged shaft, O, supported in the same bracket, and passed through a hole in the side of the shell, to give motion to the counter above. The special object of this application of the second crown wheel, is the neutralizing the lateral pressure upon the drum bearings, in the transmission of motion from one drum to the other; and to reduce the working friction to the highest degree of refinement, the total weight of each drum is calculated to be just equal to that of its bulk of the fluid surrounding it. The water enters the meter, as indicated by the duplex spreading arrow, passing first through a coarse grating, P, intended to retain pieces of wood and bulky matters, but permitting the water, with its ordinary impurities, to pass through. After passing this grating, the fluid is collected towards the axis of the shell, by the first internal conical incline, Q, of a duplex cone piece inserted within the shell, and the flow is then directed outwards by the second reverse cone, R, and spread uniformly over the quick external cone of the pieces, H. The object of this direction of the fluid, is to prevent *partial currents*, which would otherwise disturb the motion of the working drums; and as water, in passing through pipes, sometimes acquires a rotatory motion, the conical block, H, is armed with the radiating blades, K, to direct the fluid in a line parallel with the axis, prior to its reaching the drums beyond.

The current, thus uniformly spread and directed, now meets the right-handed screw blades of the first drum, E, which is thus caused to revolve,—the water, at the same time, acquiring a certain deflection, in consequence partially from the resistance of the drum to rotation, and partially from the friction of the fluid against the surface of the revolving drum.

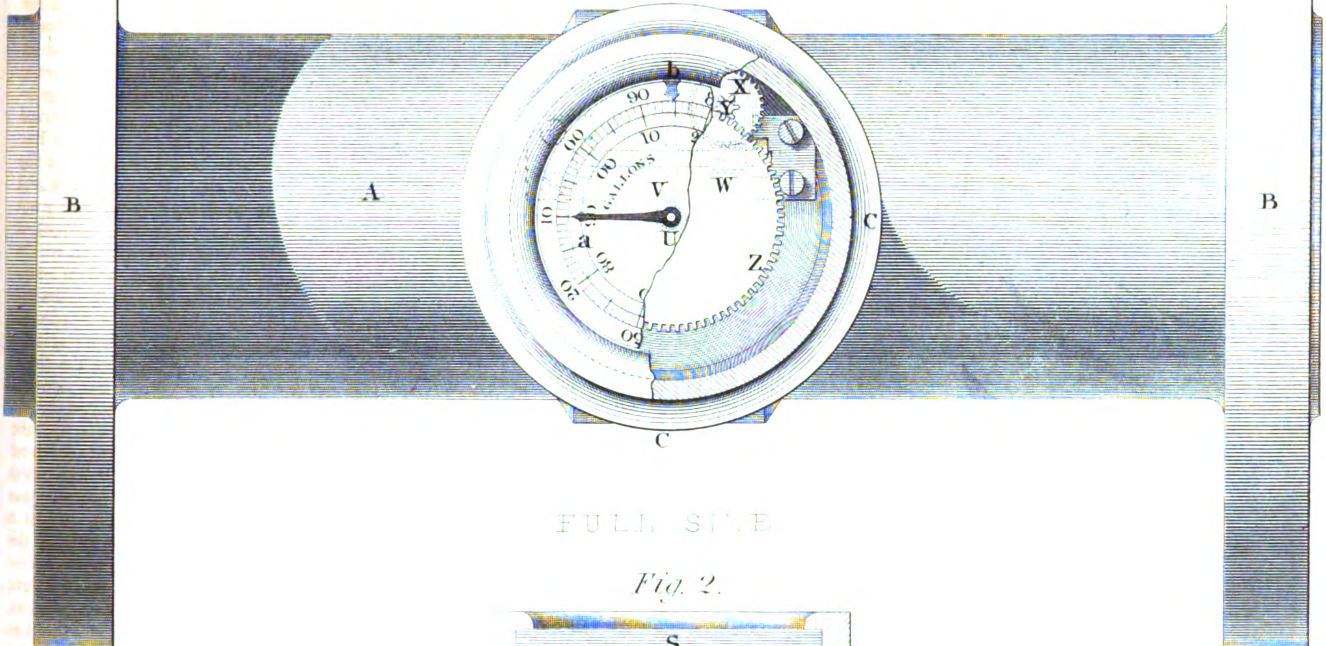
The amount of this deflection or "slip" of the water varies with the velocity of the current, and would, of course, affect the accuracy of the measurement, were it not for the correcting influence of the second or left screw-bladed drum. The blades on this drum are of precisely the same pitch as those on the first; and as they revolve, they meet the water at an angle so much greater than occurs at the first drum, as is due to this angular deflection. Hence the water tends to drive the second drum faster than the first, and the fluid suffers twice that amount of deflection in the reverse direction. Hence the combination of the two drums produces a powerful water-pressure engine, upon which the slight

* See Plates 96 and 97, for May last.

SIEMENS' PATENT BALANCE METER

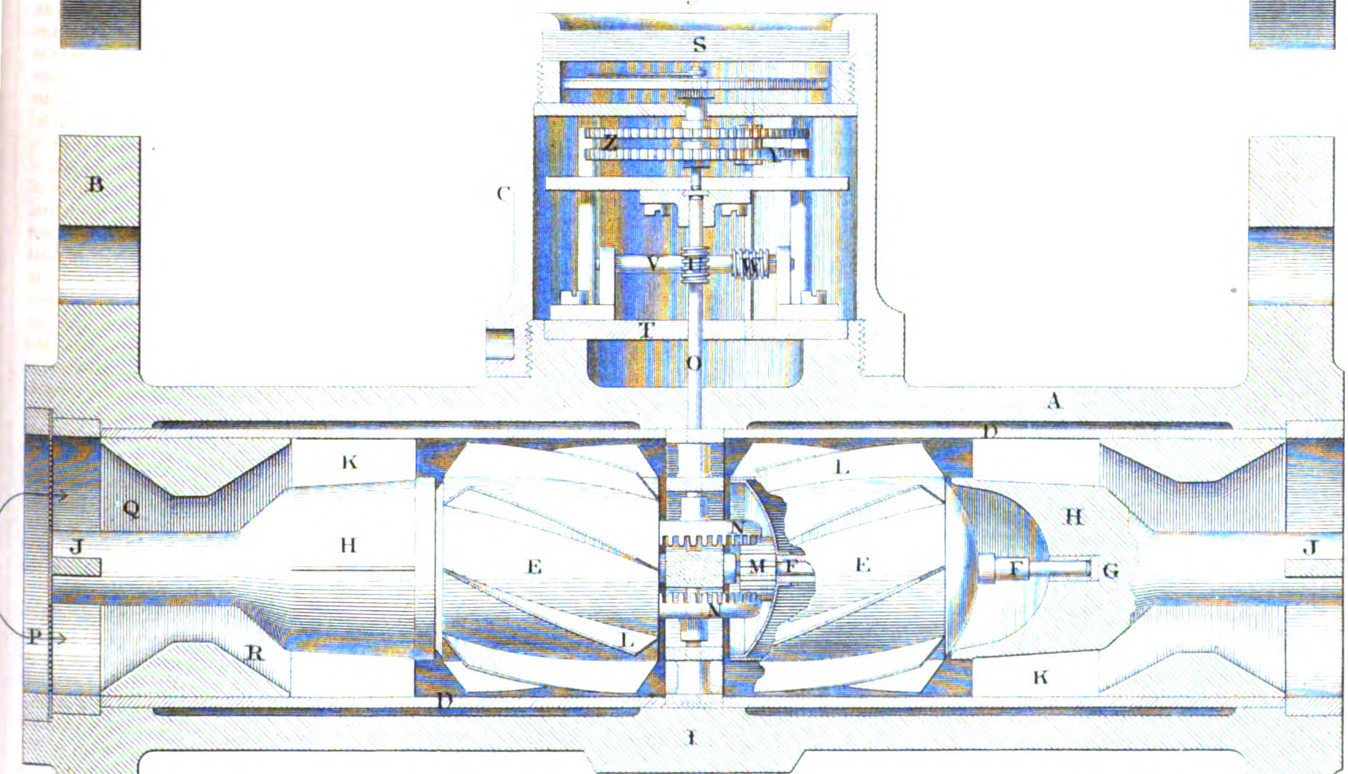
TO WORK UNDER PRESSURE

Fig. 1.



FULL SIZE

Fig. 2.



GUEST AND CHRIMES,

ROTHERHAM.

Sole Manufacturers.

W. Johnson, Patent Offices, London, Glasgow & Edinburgh.

Printed by Mackay & Kirkwood, Glasgow

Engraved by H. Adlard.

friction of the apparatus exercises no appreciable retarding effect. Moreover, the friction of the water on the drum surface increases in the ratio of its velocity, and the result is, that the combined drums move, under all circumstances, in the exact ratio of the current. The outer edges of the screw blades do not work in absolute contact with the internal surface of the fixed shell, A, but no water can slip through this way without impinging on the vanes, in consequence of a slight contraction of the shell between the two drums. After passing both drums, the water is again directed as in the first instance, and passes off to the service-pipe at the opposite end of the shell.

The counter or indicating apparatus possesses some peculiar features, as regards simplicity of details, and the dispensing with a stuffing-box for the communicating shaft, O, of the drums. It is entirely contained in the cylindrical brass case, C, in the top of which a strong plate-glass cover, S, is screwed in from the under side. A strong brass plate, T, divides the case from the meter, and has a central hole for the passage through of the vertical spindle, O. A worm, or endless screw, U, upon this spindle, gives motion to the wheel, V, the horizontal spindle of which has a worm, W, cut upon it, and gearing with a horizontal wheel, X. The spindle of this latter wheel carries a broad pinion, Y, which drives both the horizontal spur wheels, Z, the first of which has 101, and the second 100 teeth.

The wheel with 101 teeth works loose upon its spindle, but carries round with it a dial-plate, *a*, graduated on its circumference to 100 parts. The lower wheel of 100 teeth is fixed upon the same spindle as the first, and carries an index hand, which works round above the dial, and points to the divisions thereon; and a fixed hand, *b*, points as well to the same graduations. The train of worm wheels is so proportioned, that exactly 10 gallons of water must pass through the meter, in order to move the dial-plate under the fixed hand through one division. One entire revolution of the dial, consequently, indicates the passage of 1,000 gallons of water, for which the moving differential hand passes through only a single division on its dial. An entire revolution of the latter, therefore, signifies the passage of 100,000 gallons. The reading of such a dial is extremely simple. If we suppose the fixed hand to point to 47, and the hand on the dial to 89, this will show that 89,470 gallons have passed.

The whole chamber of the counter is filled with purified mineral naphtha, or other non-corrosive liquid, which communicates with the impure liquid passing through the meter, only through the medium of the capillary space round the upright spindle, O, and does not intermingle with it, although both liquids are under the same pressure.

The actual measurements by this meter have been found to agree so perfectly with the calculations, in which the frictional surfaces against the water are taken into account, that Mr. Siemens considers any means of adjustment to be unnecessary. Much, however, depends upon the formation of *perfect* screw vanes upon the drum, to insure uniform results; but all difficulty on this head has been very successfully removed, by casting the drums in metal moulds, using a peculiar composition, which does not shrink in cooling, and runs very fine.

The only parts of this meter where wear and tear is to be expected, are the pivots of the rotatory drums, and these are made of hard steel, and abut against agate plates; but considering that all weight is taken off the bearings, and that the water simply glides over the drum surfaces, these pivots may reasonably be expected to run for years without requiring attention.

An important practical advantage of this form of meter, is its compact form, and the facility which it offers for adjustment in a line of pipes below street pavement, or at any required elevation or direction. The internal working parts are quite self-contained, and inaccessible without unsoldering the ends, so that they may be intrusted to the care of ordinary workmen.

In addition to the employment of the meter for water-works purposes, it may be usefully applied for registering the water supplied to steam-boilers, in order to ascertain the actual evaporation going on, so as to afford a correct estimate of the value of the fuel on the one hand, and the engine and boiler on the other. We understand that the balance meter has already secured the sanction of many important water companies, and that the manufacturers are executing numerous orders.

MECHANIC'S LIBRARY.

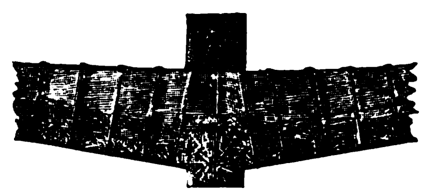
Arts and Manufactures, Novelties in, (Knight's Pocket Cyclopædia,) 12mo, 2s., cloth.
Astronomy, "Bridgewater Treatise," (Bohn's Scientific Library,) 3s. 6d., cloth. Whewell.
Chemistry, Manual of Elementary, 4th edition, 12s. 6d., cloth. Fownes.
Construction of Hot-Houses, &c., crown 8vo, 8s. R. B. Leuchars.
Gold as a Commodity, History of, 12mo, 1s., sewed. J. Ward.
Hydraulic Engineering, Principles of, 2d edition, 8vo, 12s., cloth. Dwyer.
Natural Philosophy, Hand-Book of, 2d course, 8s. 6d. Dr. Lardner.
Science, Marvels of, post 8vo., 10s. 6d., cloth. W. S. Fullom.
Ships, Hints on the Form of, 12mo, 1s., cloth. Bland.

RECENT PATENTS.

SHIP-BUILDING.

J. & R. White, *Cowes, Isle of Wight.—Enrolled September* 24, 1852.

As diagonally planked timber ships are now built, the main piece of the keel is much weakened to allow of the planks being carried over and across it. Indeed, by such a system of construction the keel is made a hanging keel, brought on after the diagonal planking has been laid, and supported only by the outer layer of longitudinal planks and bolts. Our annexed figure is a portion of a midship section of a vessel built by Messrs. White, on a plan contrived to remedy this evil. The keel is solid throughout, having rabbets on each side for the reception of the ends of the diagonal planks, as well as of the outer longitudinal planks. The floor timbers are shown above, and across them is the kelson. The keel being laid in a continuous length, the floor timbers crossed, and the kelson laid and bolted thereto, at the commencement of the building, a permanent and solid foundation is obtained. The planking of the bottom is facilitated, and one length of planking extends from the keel to the gunwales, whilst the keel is as much stronger as is owing to the diagonal planks not being carried across it. Ships with diagonal planking may thus be built to any rise of floor.



STEAM-ENGINES AND BOILERS.

W. B. Johnson, *Engineer, Manchester.—Enrolled June* 12, 1851.

Mr. Johnson's improvements in steam-engines relate to various modifications of the mechanical arrangement of the details—such as the placing a condenser beneath the cylinder of a horizontal engine, so as to form a part of the base plate; various minor modifications of parallel motions, air-pumps and condensers; and a piston and valve packing, with the spring acting in the line of a chord to the circle of the piston or valve. Under the second head he gives us several novel forms of boilers. His first boiler design appears to be the same as that already patented by our correspondent, Mr. Bourry *—the transverse section being made up of two arcs of circles, or ellipses, placed one above the other. Our figures, 1 and 2, represent transverse and longitudinal

Fig. 1.

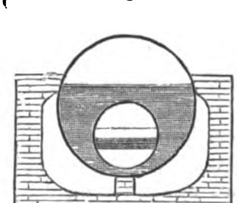
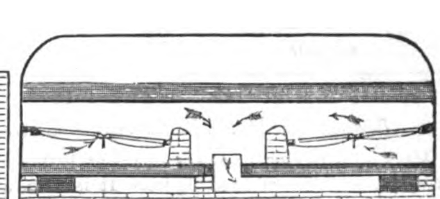


Fig. 2.



sections of another arrangement of a cylindrical boiler, with an internal flue, running directly through the shell. The furnaces, two in number, are placed, one at each end of this flue, and the gaseous currents therefrom traverse—as shown by the arrows—meeting and mingling with each other in the central space between the two bridges. There the gases

Fig. 3.

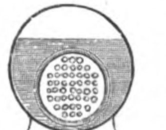
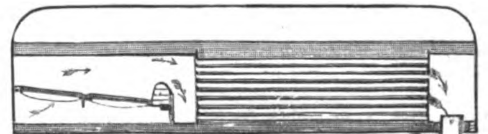


Fig. 4.



are well mixed and ignited, prior to the combined current passing off through the outside bottom flues. Figs. 3 and 4 exhibit similar sec-

* See page 45, *ante*.

tions of a tubular boiler with a single furnace. The gases here pass from the furnace into the chamber at the back of the bridge, and thence through the flue tubes into an end smoke-box, in communication with the chimney flue. The smoke-box has an end door for cleaning, and is well surrounded with water.

Mr. Johnson also shows some other modifications of boilers, specially contrived for the prevention of smoke, durability, and economy of fuel.

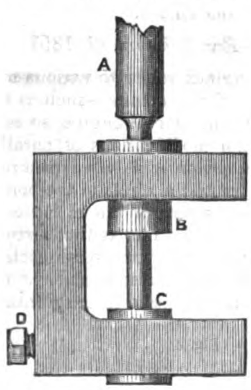
IRON SHIPS.

C. J. Mare, *London.—Enrolled August* 27, 1852.

Mr. Mare's "Improvements in Constructing Iron Ships or Vessels, and Steam-boilers," refer to the economizing of time and manual labour in fitting the sizes of plates, and the situations of the rivet holes therein, during the putting together of the component parts of the vessel. Instead of going to the trouble of hoisting up the plates as required to be built in, for a preliminary fitting in the actual position which they are eventually to occupy, Mr. Mare employs an apparatus somewhat on the principle of the "cymameter," as contrived for taking the general form of mouldings and bas-reliefs, as a variable template for defining the series of plates. This apparatus consists of a frame carrying a set of adjustable perforated bars, capable of being set to any required position in the frame with respect to each other, and having a clamp to hold them when duly arranged. Thus, by setting this frame to the form of the intended plate, the latter may be shaped from it, and the holes punched in it, without the inconvenience of hoisting the plate back and forward from the ground to the ship.

REGISTERED DESIGNS.

SPINDLE FOOT BEARINGS FOR SPINNING MACHINERY.



One-half.

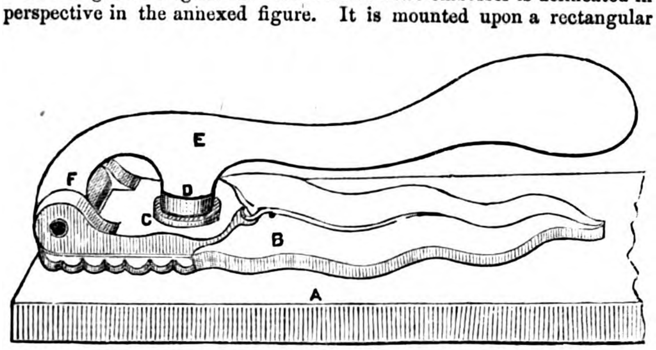
Registered for Mr. C. Carr, *Stockport.*

Our engraving represents this modification of the spindle rail, collar, and footstep, in end elevation. The spindle, A, has a long foot-piece, which is passed through a collar, B, in the upper flange of the rail, thus receiving lateral support, whilst it rests in the footstep, C, in the lower flange, this footstep being stayed by a back set-screw, D. This arrangement evidently affords an excellent steadying support for the spindle, preventing the wear and tear of the foot, where failure usually first shows itself. It also permits of easy oiling. It is now being introduced by Messrs. Elce & Co., the machine makers of the Phœnix Works, Manchester.

EMBOSSING PRESS.

Registered for Mr. S. R. English, *Bull Street, Birmingham.*

Mr. English's elegant and convenient little embosser is delineated in perspective in the annexed figure. It is mounted upon a rectangular



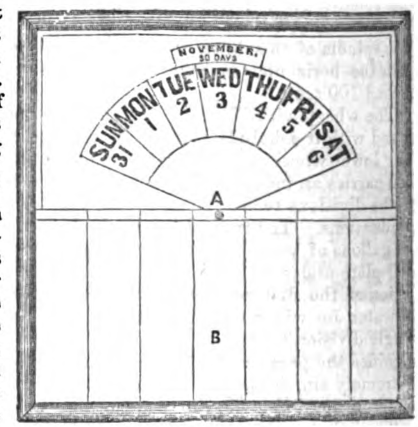
wooden base, A, to which the ornamental cast-iron bottom plate, B, is connected by a couple of small bolts passing downwards with nuts beneath the base. This plate carries the bottom die, C, which is held down by a little screw entered into the plate from the bottom of the die. The counterpart, or reverse die, D, has a projecting neck, by which it is connected to a prominence on the lever arm, E. The plate, B, is cast with a double eye at the end, for receiving the single eye, F, of the embossing lever, the connection being by a short transverse pin in the usual way.

The advantages of the new form are—simplicity of construction, with a plainly efficient embossing action, the hand having great command over the die. Besides this, the lever may be thrown entirely over, to allow of colouring its die when thus turned up—a great improvement on the ordinary plan of colour embossing.

TABLET DIARY.

Registered for Messrs. J. Blackwood & Co., *Long Acre, London.*

The tablet diary is a great improvement upon the common remembrancers usually found on the walls of the study or the counting-house. It is a square glass-covered frame, with the month and the number of days in it at the top. A radiating tablet, struck from the centre line, presents the whole seven days at once, with the corresponding days of the month on which each of these days falls throughout the month. Our figure represents a front view of the "tablet diary" complete, as set for the day on which these pages will appear. The segmental line of the week's letters is fixed, and a slot being cut in the tablet above, the month "November" appears through it, with its corresponding number of days. The months are marked on a circular disc, adjustable on the centre, A, where there is a button for setting it; and a second and third card on the same centre carries the days of the month on which the days of the week fall, the whole being adjustable by concentric buttons at A. The slate, or other tablet, B, in the lower half of the frame, is ruled in columns for the week, for daily memoranda. Messrs. Blackwood are also the originators of several other ingenuities for office purposes. Their vase ink-bottle, for example, which, whilst it forms an elegant ink magazine, is made with a small pouring neck, as an improvement upon the common clumsy bottle, whence it is impossible to draw the supplies for the inkstand without serious spilling.

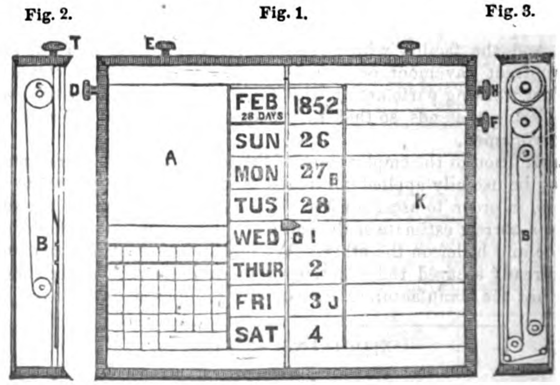


PERPETUAL REMEMBRANCER.

Registered for Mr. J. R. Isaac, *Castle Street, Liverpool.*

This is another valuable office adjunct, now being introduced by Messrs. Blackwood. Like the "Tablet Diary," it is intended for the constant adjustment of the relations of the months, weeks, and days of the year, the details being all covered in with a glass front. Fig. 1

Fig. 2. Fig. 1. Fig. 3.



represents the "Remembrancer" complete, and figs. 2 and 3 are, respectively, vertical transverse sections of the right and left sides of the apparatus. The dates of the month and the days of the week, printed in black letters on the card-board, A, are secured beneath the glass; and the months and dates of the month are printed in red, on webs, B, passing

over rollers, C, and adjustable by the handles, D E. As the figures and months follow each other, there is no turning back. To act for the month, the handle, F, is turned upwards once a-week, to remove the seven used figures, and bring forward seven more. To act for the day, the indicator, G, slides up and down the brass rod in the centre, and must be placed opposite each day consecutively. To change the months, the handle, D, is turned up. When the month is a short one—February, for example—and the last day falls in the middle of a week, the week would be imperfect; therefore the handle, H, turns up a blind, J, having the first six figures printed on it in blue. This is stopped when it meets the 28th, thus perfecting the week. At the close of the week, the handle, H, is turned the reverse way, and the blind stands out of sight until again wanted. At an opening in the upper edge of the frame, a tablet, or card, K, for general memoranda, is introduced; and at a central opening, a card for the year is entered. Such a contrivance evidently furnishes all the requirements for a correct perpetual adjustment.

PORTABLE ASBESTOS GAS STOVE.

Registered for Mr. E. Goddard, *Ipswich.*

As the engineer of the Ipswich Gas-Works, Mr. Goddard has had peculiar facilities for working out his plans for the general introduction of gas as a means of heating and cooking; hence the world is indebted to him for several varieties of apparatus which are now contributing very materially to our domestic comfort. But in this country we must see our fire; it is not the mere warmth of the room that is wanted. Mr. Goddard has felt this, and has contrived to supply the want, by giving us a visible gas fire, by the aid of asbestos.

Fig. 1.

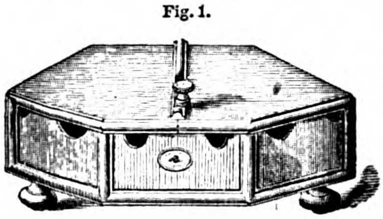


Fig. 1 represents such a stove or grate, as closed up when out of use, ready for transport. Fig. 2 shows it open, with its flattened coil-burner exposed; and fig. 3 is an incollapsable grate with the fire lighted. The grate, or fire-chamber, is coated internally with porcelain, and within this is the tubular burner, fig. 2, set at an angle of 45°. When the fire is to be lighted, a handful of asbestos shavings is spread over the burner, and the gas is then turned on and ignited, at once producing a mass of what looks very like the incandescent fuel of our common grates. The loose fibrous nature of the asbestos gas-wick, as we may term it, is excellently adapted for admitting an abundance of atmospheric air, so that the gas is fully consumed without smoke or escape. A fire of this kind for an ordinary room, consumes about 7 feet of gas per hour, costing something like 4d. for twelve hours. The asbestos used as fictitious fuel, costs 2d. to begin with, and, being nearly indestructible, the cost of keeping it up is inappreciable.

Fig. 2.

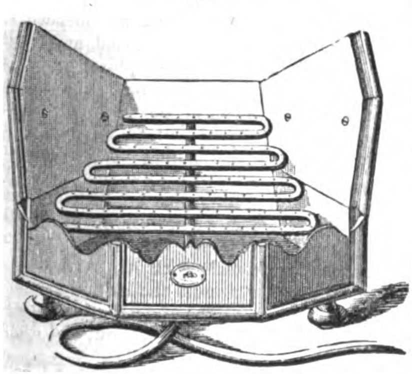
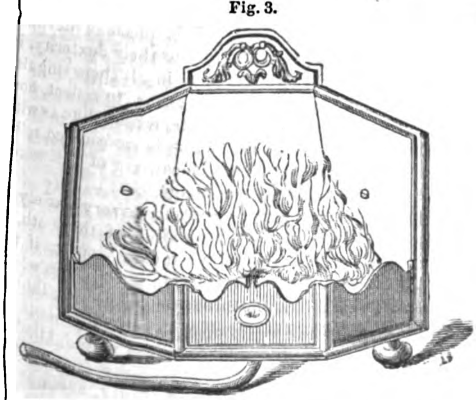


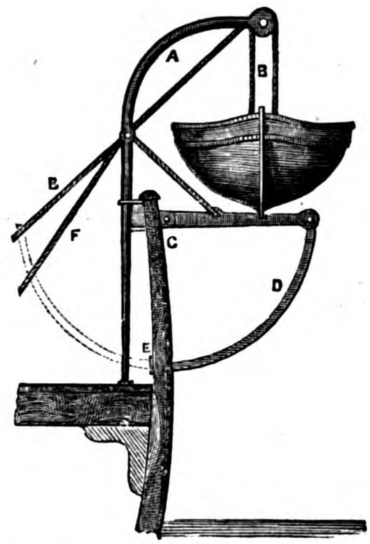
Fig. 3.



BOAT CRANE.

Registered for Mr. R. Grundy, *Rio de Janeiro.*

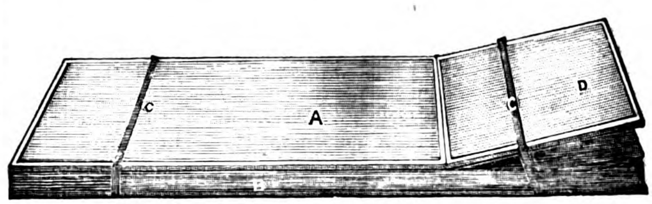
The peculiarity of this contrivance is the placing a horizontal support beneath the boat, in such a way as to retain the boat securely in position when hauled up, whilst it may be easily cleared away when the boat is to be launched. Our engraving shows the plan as adapted to a boat on the quarter—a portion of the ship, at that point, being represented in transverse vertical section. The suspension from the pair of davits, A, is in the usual manner, B being the tackling for hoisting and lowering. At C, a stout lever is hinged to the side of the ship at each davit, the free end of this lever being connected to a quadrant piece, D. The termination of this quadrant, E, is passed through a hole in the side of the vessel, and rests against a short hinged detent lever in the inside of the gunwale. When the boat is to be lowered, the line, F, which is passed over a fixed pulley on the side of the davit, and attached at its outer end to the lever, C, is slackened, and the detent at E being shifted, the lever, C, falls, permitting the boat to be lowered away, whilst the quadrant, D, enters thro' the vessel's side, and occupies the position of the dotted lines.



READY REFERENCE FILE.

Registered for Messrs. Blackwood & Co., *Long Acre, London.*

The simple "ready reference file" is another useful contrivance which we owe to Messrs. Blackwood. It is represented in our perspective sketch as opened for reference. It is nothing more than two pieces of



stout covered pasteboard, A B, of the size to which the papers are folded. To the bottom one, B, are attached two elastic bands, C, capable of embracing the upper board, A, which latter has a flexible hinge, or cloth joint, in it near one end, so that the piece, D, can be elevated at pleasure. It is thus easy to see that the extension of the elastic bands will permit of the insertion of a goodly file of papers between the boards, whilst the elevation of the flap-piece, D, admits of reference to the endorsements of the letters, any of which may be removed without disturbing the rest, the file being simply held by the clipping tension of the elastic bands.

REVIEWS OF NEW BOOKS.

The Arts and Manufactures of India. By Professor Forbes Royle, M.D., F.R.S. Bogue: London.

If we take an uncoloured and extended map of the world—let it be the well-remembered one, "on Mercator's projection"—and just tint England and its dependencies, we cannot but be struck with the peculiarity of its position among the other ruling powers of the earth. It is not its scattered millions that produces this effect; for a nation to which we must ever look up as our earliest historians, poets, moralists, and

divines, has long had its people distributed into many more chinks and crannies than our own. It cannot be that we are thus affected by reason of the aggregate extent of territory possessed by us; for in numbers of square miles we are greatly exceeded by the Autocrat of all the Russias. But look again at the map, now, and see the comparatively minute speck, whence the adventurer, whether the mariner, the soldier, or the civilian, has departed, and, by fair means or foul (it is not convenient to search too pryingly into the past to ascertain which), has returned but to record the acquisition of some new land, or the homage of some stranger-people. *Some* virtue must have gone out of the little spot to produce the harvest we are now reaping; a strength of some kind must have been manifested, in order to cause the little to overcome the great. What virtue, what strength, does this picture prove it to have been, that has thus exalted the nation? *There*, in that vast, and, as yet, undefined territory, founded by the Pilgrim Fathers, the germ of a mighty American empire has been sown by their piety and zeal, and is now being nourished with the best blood of Old England. *There* is that enormous island-continent, now first becoming a stated refuge for the intelligent and industrious, but recently regarded as the dismal and distant sea-bound prison of the malefactor. *There* is that southernmost land of slave-yielding Africa, forming the half-way-house, the new home of Australia. And *there*, forcing its wedge of power into the far Indian Ocean, is that most ancient land, one of the earliest seats of civilization, which, among all the Indies, claims and receives, by excellence, the name of 'India.' The setting sun of Canada forms the morning joy of New Holland, whose evening shadows are to Britain but as the harbingers of useful day. Stereotyped expression is no hyperbole, and literally, hour after hour, does the world present some portion of its British surface to the sun, forming a zone, somewhat different from the merely physical, at once exercising, and being impressed by, all favourable influences.

Among these dependencies, India, very naturally, claims the foremost place. We did not raise India; we did not even plant the seed. But the civilized-in-a-certain-way of many centuries have gradually become tributaries, as circumstances, be they what they may have been, have necessitated our Anglo-Saxon dominion over its gentler activities. A superstitious vegetable-eating, cloth-weaving race, could offer no obstacles to our will to become their masters; and when once such a moral chain has been riveted on, we cannot imagine the occurrence of any circumstance but which shall tend to consolidate it.

Dr. Royle divides his Essay thus:—I. Chemical Arts. II. Textile Arts. III. Manual and Mechanical Arts. IV. Fine Arts. Of each of these he treats more at length than most of the lecturers, on this occasion, who have preceded him; and, in all, he manifests a thorough knowledge of his subject, as, at the same time, he evinces an interest, which he has contrived to make so *catching*, as to make us fancy it to be not in a little degree personal.

It is impossible, within the limits to which we are confined, to notice, at any great length, the many matters necessarily claiming Dr. Royle's attention in the pages before us. We cannot hesitate, however, to extract the following, although somewhat lengthy. The lecturer is speaking of the Indian mode of manufacturing steel. He says—

"Mr. Heath describes the one used as the magnetic oxide of iron, consisting of 72 per cent. of iron, with 28 of oxygen, combined with quartz, in proportion of 28 of oxide to 48 of quartz. It is prepared by stamping and then separating the quartz, by washing or winnowing. The furnace is built of clay alone, from 3 to 5 feet high, and pear-shaped; the bellows is formed of two goatskins, with a bamboo nozzle, ending in a clay pipe. The fuel is charcoal, upon which the ore is laid without flux. The bellows are plied for four hours, when the ore will be found to be reduced: it is taken out, and, while yet red hot, it is cut through with a hatchet, and sold to the blacksmiths, who forge it into bars and convert it into steel. In an old account which I possess, written on the spot, apparently in Mysore, it is said that one pound and a half is heated lower than red heat, and then beaten for about three minutes with a stone hammer on a stone anvil, experience having taught them, they say, that instruments of iron ruin the process. Mr. Heath says the iron is forged by repeated hammering, until it forms an apparently unpromising bar of iron, from which an English manufacturer of steel would turn with contempt, but which the Hindoo converts into cast-steel of the very best quality. To effect this, he cuts it into small pieces, of which he puts a pound, more or less, into a crucible, with dried wood of the *Cassia auriculata*, and a few green leaves of the *Asclepias gigantea;* or, where that is not to be had, of the *Convolvulus laurifolia*. The object of this is to furnish carbon to the iron.

"As soon as the clay used to stop the mouths of the crucibles is dry, they are built up in the form of an arch in a small furnace; charcoal is heaped over them, and the blast kept up without intermission for about two hours and a half, when it is stopped, and the process is considered complete. The furnace contains from 20 to 24 crucibles. The crucibles are next removed from the furnace, and allowed to cool; they are then broken, and the steel taken out. The crucibles are formed of a red loam, which is very refractory, mixed with a large quantity of charred husk of rice.

"Mr. Heath, after observing on the astonishing fact of the Hindoos having discovered the way of making steel at such early periods, refers to Mr. Mushet's discovery of converting iron into cast-steel, by fusing it in a close vessel in contact with any substance yielding carbonaceous matter; and then to that of Mr. Mackintosh, of converting iron into steel, by exposing it to the action of carburetted hydrogen gas in a close vessel, at a very high temperature, by which means the process of conversion was completed in a few hours, while by the old method it was the work of from fourteen to twenty days,—Mr. Heath observes: 'Now, it appears to me that the Indian process combines the principles of both the above described methods. On elevating the temperature of the crucible containing pure iron, and dry wood and green leaves, an abundant evolution of carburetted hydrogen gas would take place from the vegetable matter, and as its escape would be prevented by the luting at the mouth of the crucible, it would be retained in contact with the iron, which, at a high temperature, appears, from Mr. Macintosh's process, to have a much greater affinity for gaseous than for concrete carbon. This would greatly shorten the operation, and probably at a much lower temperature than even the iron in contact with charcoal powder. In no other way can I account for the fact, that iron is converted into cast-steel by the natives of India in two hours and a half, with an application of heat that in this country would be considered quite inadequate to produce such an effect; while at Sheffield it requires at least four hours to melt blistered steel in wind furnaces of the best construction, although the crucibles in which the steel is melted are at a white heat when the metal is put into them, and in the Indian process the crucibles are put into the furnace quite cold.'"

We had marked for extract a very interesting account of the cotton manufacture, on which Dr. Royle has, as is well known, bestowed a very great amount of accurate attention, and for which all manufacturers of the substance owe him a full measure of gratitude. It will be found in pp. 228—231, inclusive, of the volume of these lectures, published for the use of the members of the Society of Arts and Manufactures, and is well worth a careful perusal, not only on account of its interesting details, but for the suggestions it contains for the further improvement of what may now be said to be the changed staple manufacture of our country.

Where the manufacture of cotton has attained a world-famous reputation for fineness and softness, it is natural to conclude that some arts, intimately associated with it, should also have arrived at great perfection; and we, accordingly, find some localities "famous for bleaching, such as Dacca and Baroche;" and scarcely any surprise can be expressed at what Mr. James Taylor, in his "Account of the Cotton Manufacture in Dacca," tells us, or leaves to be inferred, that the process of bleaching at that place, includes what are called the modern discoveries of Europe.

The art of calico-printing has, for many ages probably, been successfully practised in India, where, as in some other parts of the East, we must conclude it to have originated. Some of their dyes, too, are still desiderata to the English manufacturer. "Printing in gold and in silver is a branch of the art which has been carried to great perfection in India, judging by the several specimens sent to the Great Exhibition from very different parts of India, as well upon thick calico as upon fine muslin."

Our earliest associations with the name of India are blended with visions of great moguls, elephants gorgeously caparisoned, and resplendent with the diamonds of Golconda, and oriental sapphires, rubies, and pearls; with kings as but subjects of a higher grade, and rajahs of indefinite power. A wild imaginative faith, the records of which assume to come from times verging, by particularized number, on infinity, clings to our earliest memory, and challenging, at the same time, unknown antiquity for the original formation of the existing distribution of its people into their well-known and peculiar *castes*. So long, indeed, have the people in general been situated as we now see them, that they have brought down to this very age, together with their "perfected religion," the arts and sciences "perfected" with it. And it is but requisite to look upon their forms of the plough, the grinding-mill, the potter's wheel, and the loom, to view also the early barbarism which established the original worship of Buddha, Siva, Vishnu, and Juggernaut.

How much has the prevailing national religion to answer for, both as regards the advance and retrogression of all the arts of civilized life! This observation is by no means applicable alone to India, among the labours of whose earliest and latest sculptors in wood or stone, and painters (for they had such), are the uncouth forms and delineations of the idols to whom they still bow the soul. This phase of devotion no doubt originated, as it has tended to contribute to their dexterity, in such manipulations of wood and ivory as were seen, in all their singular power, in the Great Glass House. It is impossible but to reflect, how widely different is the case in Mohammedan countries, where, like as with the Jews, the second commandment of the decalogue is considered to be correctly interpreted by acting upon the literal meaning of the words —"Thou shalt not make to thyself any graven image."

The resources of India are great, and presenting every variety of climate in its extended domain, from the burning plains of the south, to the perpetual snows of the lofty Himalayas, we must expect, if the affairs of the world continue in about the same relative position in which they now are, and the facilities of travelling progress like other things, that the tide of emigration now flowing from our own home, will stimulate, with its healthy muscular energies, the enfeebled races of Hindostan. Long must it be before its millions of square miles may exhibit an adequate population; but it is already making such an impression on men's minds, as at once to elevate it into a mighty sovereignty, destined to influence the whole of Asia. The East India Company, in whom still, in a great measure, rests this destiny, both near and far off, have hitherto been entitled, from their prudent government, to the grateful thanks of

all who have the welfare of wide mankind at heart. And the grand collection of raw and artificial produce which was brought together within the walls of the Crystal Palace, has contributed to excite all imaginations to the splendour of our Eastern possessions, and to the means we own in them towards the amelioration, not only of Asia, but of our species in general. We can only conclude with one of the ancient French modes of speech, with which our sovereign gives the royal assent to acts of parliament—*Soit fait comme il est desiré.*

THE PRINCE OF PALMS; being a short account of the Cocoa-Nut Tree, showing the uses to which the various parts are applied, both by the natives of India and Europeans. London: T. Treloar, Ludgate Hill. Pp. 16. 1852.

Linnæus has aptly termed the cocoa-nut the "Prince of Palm Trees," and Mr. Treloar, to whom much is owing for his enterprise in bringing the fibrous products of the tree within the range of the industrial arts, has seized the idea, for judicious application, in drawing an attractive title for the pamphlet before us. He tells us that—

"In 1813, it was estimated that, on the south-west coast alone, of the former, ten millions of cocoa-nut trees at least were growing. The tree begins to bear when about eight years of age. The nuts that are intended for planting are allowed to remain on the tree longer than others. They are taken off when thoroughly ripe, after having been put into a shed or outhouse, till all the moisture of the thick outside husk or bark is dried up. They are hung in pairs over the branches of some trees near the house, where they remain till the young plants shoot up with a firm leaf through the eyes of the nut. Instead of hanging them up in trees, some persons put them into their gardens three or four hundred together, and half cover them with earth. In this way the young plants soon make their appearance. When the leaf is about three feet high—at which time also there are long straggling roots hanging to them—holes are dug in the ground, about two feet deep and one and a half feet in diameter, into which the plants are put, about two yards apart from each other; a little earth is thrown in upon them, but not so as to cover the nut. For several years they appear to advance but little in height. During this time, however, their trunk is increasing in bulk: and from the fifth to the seventh year, or thereabouts, they grow to a considerable height. Soon after, a sheath containing the blossom appears, shooting out from the inner side of the thick butt-end of the leaf; and when about a foot high and two inches in diameter, the sheath bursts; and in a few days the different portions of the flower, consisting of innumerable small seeds, attached to a long stake, bend down very gracefully on all sides. After a while, a great number of these seeds fall off, and small nuts, to the number of twenty to fifty, on an average, remain on one stalk. From the time that the flower bursts, to the time when the nuts are ready to be gathered, there elapse about six months.

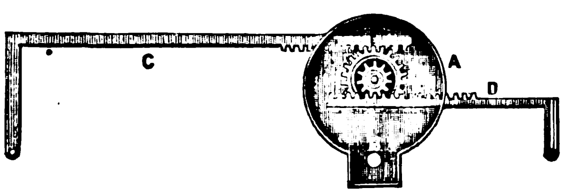
"The leaves of some trees are twenty-five feet long, and the small leaflets that hang down from each side of the thick middle fibre four feet long. As the leaves are of this length, and very heavy, it is necessary that some provision should be made for attaching them firmly to the trunk. This provision is made, and consists of a very strong net-like substance, extending about a foot along the base of the leaf; and as the inner part of the butt of the leaf is *scooped out* in order to grasp and enclose the trunk more firmly, this netting holds it tight round the tree, and binds it fast till it has performed its office of acting as a support to the cluster of nuts that rest upon it. This network is called 'matulla,' and is one of the most curious productions of nature. The threads or fibres are so regularly crossed and interwoven, that to one unacquainted with the article it would appear to be a species of coarse cloth manufactured in the loom. Without preparation, this material is well adapted for sieves and filters; and its natural texture renders it, in the hands of the ingenious, an admirable substance for the formation of clothes."

The Cingalese have a saying, that the tree has ninety-nine uses, and the hundredth cannot be found. Of these, native ingenuity has developed a great proportion; but it has been left for Europeans to show what can be done with the fibre. Amongst other inventors of uses, Miss Martineau has proposed cocoa-nut matting instead of litter for cows—remarking that the mats "would make excellent bedding for 'refuge houses'—I am sure I could sleep well on them." From the root to the leaf, each part has an important value; fruit, shell, timber, and fibre, all combine to furnish something for the use of man. Such uses Mr. Treloar brings forcibly before us in practical language; and, more especially, illustrates his subject by his own successes in utilizing the fibre, by turning it into mats, brushes, bedding, and baskets.

CORRESPONDENCE.

FORSTER'S PENTAGRAPHIC INSTRUMENT.

The little instrument delineated in my annexed sketch, is, I think, superior to the common pentagraph, from its essential feature of compactness.



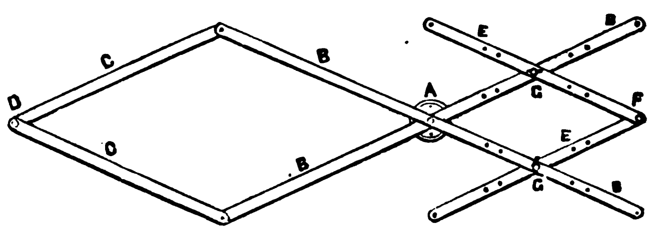
The small and shallow circular box, A, contains the actuating mechanism, and is arranged to turn at pleasure upon the fixed centre stud, B and from each side of the box, a rod, C D, projects, the points of the rods being brought into a horizontal line with the stud centre, B. The box is in horizontal section, to exhibit the internal gearing. The end of each rod has rack-teeth upon it, the teeth on the rod, C, gearing with a spur-wheel, E, fast on a stud in the centre of the box; whilst the other rod, D, similarly gears with a pinion, F, on the same centre. These two wheels are, of course, changeable, their relative radii being always determinable by the proportion to be observed between the original and the copy, of any drawing to be reduced or enlarged by the instrument. The same relation is also to be kept up between the lengths of the two rods, in order that both the rotatory and longitudinal traverse actions may coincide. It is then obvious that whatever figure is traced out by the point on one rod, will be delineated by the pencil on the other, in the proportion determined by the wheels and the leverage of the rods. The rods may be either worked on opposite sides, or both on the same side.

R. FORSTER, JUN.

Dublin, October, 1852.

IMPROVED PENTAGRAPH.

I send you a sketch of a Pentagraph which I have invented, and which I think is very simple. As to its novelty I cannot be certain, but I have never seen one like it.



On a fixed pivot, A, are a couple of rods, B, jointed at one side to two rods, C, of half their length, jointed to each other, and carrying a tracing point at the joint, D. On the other side are two rods, E, also jointed together, carrying a pencil at the joint, F, and connected to the rods, B, by adjustable joints, G, being formed by a pin passing through the rods, having a small thumb-nut at the top, or in any other convenient way. It will be seen that, with this arrangement, the rods will be disposed in the form of two parallelograms, and it is on the relative proportions of the linear dimensions of these parallelograms that the scale of the copy of the drawing traced depends. As here drawn, the pentagraph would reduce a drawing one-half; or, if the tracer and pencil were transposed, would increase it to twice the linear size.

In setting the instrument to any scale, it is necessary to make the four sides of the smaller parallelogram equal, otherwise, when straight lines are being traced, curved lines will be drawn by the pencil—that is, the copy will be distorted.

I hope you will deem the above worthy of insertion in your valuable periodical.

GOOSEQUILL.

October, 1852.

WHITELAW'S DIFFERENTIAL BEAM ENGINES.

Continuing the subject on which I wrote to you in August last, I find that my opinion on the possibility of constructing an equally divided beam engine, to take up no more space, and be equally as effective as a differential beam engine, is pretty generally admitted on all hands—nor has the letter of Mr. John Dods, in your September part, at all altered my view. That correspondent wishes to know how the altering the length of one end of the beam can be detrimental to the slide action. Let me here refer to your excellent plate 101 on this head. In the unequally divided beam, fig. 3, the length is represented as 9 feet 8 inches; and as the short end next the cylinder is 3 feet 8 inches, it follows that the longer end is 5 feet 10 inches in length; whereas, in an equally divided beam, each end would be 4 feet 9 inches long. Now surely any one may see that there must be more friction on the piston-rod slides of the former engine than on the latter, even without possessing any great knowledge of the principles of mechanics; and I am still bold enough to aver, that such friction will counterbalance the gain secured at the crank.

Neither can I see any advantage in the new governor over Field's. On the contrary, I must say I conceive it to be nothing more than a very

unmechanical imitation of the older invention, and involving a great deal more friction—though Mr. John Dods takes it so very lightly in this case. Notwithstanding his inventive genius has been brought to bear upon it, it involves a great deal more work, and possesses a decided disadvantage, which he kindly overlooks, in the fact, that the action of the cam will incline it to run up or down the spiral.

But I am glad to find that Mr. Dods has taken so sensible a course as the making the equilibrium valve a differential one, reducing the pressure on the back to two-thirds. I am quite aware that such a contrivance will help to do away with the nice little condensing apparatus of which he has such a horror; but as it will, unfortunately enough, be at hand in case of priming—the valve getting off its face, or from the effects of wear—I would suggest to Mr. Dods, as he has been considerate enough to reduce the pressure and invent a new pump, possessing the advantage of being twice as complex as the old one, he should shelve it along with the star wheels. Finally, I have to offer him many thanks for his kind advice, and his elucidation of the first general principles of mechanics, and have to express my excessive delight with his very original spirit of invention.

J. F.

Derby, October, 1852.

THE NEW PATENT LAW.

The "Patent Law Amendment Act, 1852, has now got fairly to work, and, by the time this page issues from the press, there is every probability that the number of separate applications for patents under it will amount to 500. The very important changes as to cost, and the routine of patenting introduced under this law, must render all practical information thereon of some value in the estimation as well of inventors as of that mass of the public which is interested in the progress of industry; and hence the columns of the *Practical Mechanic's Journal* may well afford space for the following paper on the subject:—

Inventors, whether British subjects or Foreigners, may obtain Letters Patent from the Crown, protecting, for fourteen years, such Inventions as they themselves have made, or have derived from foreigners not domiciled here. But the Patentee must himself be the actual Inventor, or the first importer of an Invention; and a Patent for any part of the realm will be void, if the Invention, in respect of which it was granted, was publicly known in another part of the realm at the date of the Patent. And where the subject has already been patented in any foreign country, the British Patent will cease at the same period as the Foreign Patent. No Patent can be obtained for an Invention for which a Foreign Patent has been granted, and has expired.

One Patent will not be granted for several distinct and separate Inventions, but the Patent will not be refused where one Invention is applicable to the improvement of several manufactures, or where several Inventions are applicable to the improvement of one and the same manufacture.

THE TITLE.

When an Inventor has resolved to apply for Letters Patent, the first thing to be considered is the Title of his Invention, which must be given in the Patent. There is often a good deal of difficulty in selecting a proper Title, and Inventors have not unfrequently lost the benefit of their Patents in consequence of an error in this point. In cases of doubt or difficulty, the Inventor ought to apply at once to a Patent Agent.

When the Inventions are applicable to known manufactures, or to known machines, the Titles of Patents must state the manufactures or the machines; and, where it can conveniently be done, the part thereof to which the Inventions relate.

When a manufacture is carried on by several distinct processes, branches, or machines, the Title of the Patent must state to which of the processes, branches, or machines, the Invention relates.

If the Invention relates to an engine for producing power to be worked by mechanical means, or by water, steam, air, or gases, galvanic or other fluid, the Title must state which of the means is to be used.

If the Invention relates to some process to be performed on known fabrics or manufactures, the process and manufacture must be stated in the Title.

If the Invention relates to the application of known materials to new purposes, or to the improvement of old manufactures, the Title must state the purpose or manufacture, and may state that it is to be improved by a new application of known materials. It is, however, the most prudent course for the Inventor to supply his Agent, in the first place, with the fullest possible description of the Invention, and leave him to draw the Title in accordance with it.

PROVISIONAL PROTECTION.

Inventions may be protected so as to enable their owners to use and sell them for a period of Six Months, on lodging, with a Petition and Declaration, a Provisional Specification, and having obtained the Law Officer's certificate, approving of the Title and Provisional Specification.

The Provisional Specification must state the nature of the Invention, so as to distinguish it from what is already known, in order that the extent of the Invention may be clearly understood. It need not, however, describe the manner in which the Invention is to be performed.

The object of a Provisional Specification is to provide against the introduction into the Complete Specification of any matters of Invention differing from those for which the Letters Patent are granted. It is not intended in any way to prevent the Patentee including in his Complete Specification those improvements in practical details which may occur in carrying out his Invention, provided that those improvements require the use of the original matter of Invention which is set forth in the Provisional Specification for which the Patent is granted. As the validity of the Patent depends principally upon the Provisional Specification, it should be framed with the greatest care and consideration. The entire expense of this step, including all agency and other charges, is £10. 10s.

The Petitioner may file a complete Specification, if he thinks proper, with his Petition and Declaration, in which case the Invention is protected from the day of the deposit, but it does not appear advisable to adopt this course in many cases.

COMPLETION OF THE PATENT.

The Patent must be completed prior to the expiry of the six months' Provisional Protection, and as twenty-one days' notice by advertisement is to be given in every case where a Petitioner is desirous to proceed—and, if opposed, a further delay of more than a week will take place—the Inventor must determine on proceeding or otherwise at least six weeks before the expiry of his Provisional Protection.

The entire expense of a Patent for England and Wales, Scotland and Ireland, is £30. When an intending Patentee calculates the cost of his undertaking, he must add to this the cost incurred by a Specification.

THE SPECIFICATION.

Within six months from the date of the deposit of the petition, declaration, and particulars of the Invention, a Specification has to be prepared and filed. This instrument requires the utmost care in its preparation, and, if necessary, it must be accompanied by drawings. The insufficiency of Specifications has led to the loss of more Patents than any other cause. The cost of a Specification varies, of course, with the nature of the description, the plans, drawings, &c.

Where drawings are required to explain the Invention, five copies have to be prepared—one to attach to the Deed, another for the office where filed, a third to be deposited in an office in Edinburgh, the fourth for a similar office in Dublin, and the last for the Queen's Printer, by whom all Specifications and accompanying Drawings have to be printed.

To enable Inventors desirous of protecting their Inventions from being pirated until they have themselves obtained Patents, and to afford Manufacturers and others information as to applicants for Patents for any particular manufacture, notices will be forwarded to parties desiring them of all applications for Patents for any one subject, for one year, on payment of one Guinea. This system is adopted to replace the old plan of caveats, the Law Officers having, under the recent Act, abandoned the issue of caveat notices.

Inventors residing in the country should forward the particulars of their Inventions to their agents, who, by return of post, will forward the necessary papers for their signature, and will obtain the Provisional Protection within a week from the day of application.

Such a total change as this may well be looked upon as affording a new impulse to invention, and a vast extension of the field of commercial enterprise.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

MEETING OF THE BRITISH ASSOCIATION AT BELFAST.

SECTION A.—MATHEMATICAL AND PHYSICAL SCIENCE.

THURSDAY.

The following papers were read:—

"Fifth Report on Observations of Luminous Meteors," by the Rev. Professor Powell.

"On the Action of those Storms to which the Rotatory Theory has been usually applied," by Mr. R. Russell.

"Observations on the Zodiacal Light made at the Kew Observatory, from January to April, 1850," by Mr. H. R. Birt.

"On the Reconcentration of the Mechanical Energy of the Universe," by Mr. W. J. M. Rankine.—Mr. Rankine observed, that it has long been conjectured, and is now being established by experiment, that all forms of physical energy, whether visible motion, heat, light, magnetism, electricity, chemical action, or other forms not yet understood, are mutually convertible; that the total amount of physical energy in the universe is unchangeable, and varies merely its condition and locality, by conversion from one form to another, or by transference from one portion of matter to another. Prof. W. Thomson has pointed out, that in the present condition of the known world there is a preponderating tendency to the conversion of all the other forms of energy into heat, and to the equable diffusion of all heat; a tendency which seems to lead towards the cessation of all phenomena, except stellar motions.—The author of the present paper points out that all heat tends ultimately to assume the radiant form; and that, if the medium which surrounds the stars and transmits radiation between them be supposed to have bounds encircling the visible world, beyond which is empty space, then at these bounds the radiant heat will be totally reflected, and will ultimately be reconcentrated into foci; at one of which, if an extinct star arrives, it will be resolved into its elements, and a store of energy reproduced.

"On the Causes of the Excess of the Mean Temperature of Rivers above that of the Atmosphere, recently observed by M. Renou," by Mr. W. J. M. Rankine. M. Renou having for four years observed the temperature of the river Loire at Vendome, as compared with that of the atmosphere, has found, that the mean temperature of the river invariably exceeds that of the air, by an amount varying from 1½ to 3 centigrade degrees, and averaging 2°·24 centigrade, and a similar result has been deduced from observations made by M. Oscar Valin, on the Loire at Tours. M. Renou and M. Babinet account for this fact by the reradiation from the bed of the river of solar heat previously absorbed by it. Mr. Rankine thinks this supposition inadequate to account for the facts; because the excess of temperature of the river over the air was considerably above its mean amount in November, and very near its maximum in December; and because the mean diurnal variation of temperature of the river was much less than that of the air. He considers that friction is more probably the principal cause of this elevation of temperature; for if water descends in a uniform channel, with a uniform velocity, from a higher level to a lower, the whole power due to its descent is expended in overcoming friction; that is to say, is converted into heat, as the experiments of Mr. Joule have proved. This must cause an elevation of temperature, which will go on until the loss of heat by radiation, conduction, and evaporation balances the gain by friction, and at this point the temperature of the river will remain stationary.

"On certain Magnetic Curves, with Electrical and Hydrodynamical Applications," by Professor W. Thomson.

"On the Mutual Attraction between two Electrified Spherical Conductors," by Professor W. Thomson.

"On the Form of Images produced by Lenses and Mirrors of different sizes," by Sir David Brewster.—The object was to show that the photographic portraits taken with cameras with large object-glasses, or large mirrors, must necessarily be distorted and hideous, as in fact it is notorious they are; and that hence all persons engaged in this new and most important art should receive with gratitude any scientific discovery which promised to correct so serious a defect; which by some has been attributed to the imperfection of the lenses employed; by others to the unsteadiness of the sitter who is having his portrait taken; by others, again, to the constraint of features and limb under which he submits to the operation; but it is by all admitted and deplored. If we consider that the pupil of the human eye is only about 2-10ths of an inch in diameter, it is obvious that the images formed by the eye of those solid objects placed in front of it, and by which we are accustomed to see them, to judge of them, and to recognize them, cannot embrace any of the rays of light which come from those parts of the object which lie in such positions towards the sides, top, bottom, or hinder parts, as cannot pass in straight lines to an aperture of the size of the pupil; in fact, unless it agree almost exactly with the exact perspective form of the object, the pupil being the point of sight. If then an object be placed before a lens, the part of the lens towards its centre of the size of the pupil is capable of forming a correct image of that object, consisting of rays coming from precisely the same parts of it as an eye would receive were its pupil in the same position. But all the parts of the lens or mirror of the same size which lie around and at a distance from this portion of it, would receive rays coming from parts of the solid object which the true eye could not receive, and which must therefore form as many unnatural images as there were such parts; and the photographic picture which embraces and confounds into one hideous mass all these, any one of which by itself would be correct, must, in the very nature of things, give a most confused and displeasing representation of the object. Sir David illustrated and proved these assertions by a diagram of a lens with a simple solid form, a cylinder topped by a cone behind, placed in front of the lens, pointing out the parts which alone could be embraced in a correct perspective view of it, and what parts the large lens or mirror would moreover receive and transmit rays from, to be jumbled in the photographic picture, with that which would alone give a correct idea of the object as seen. He showed, from the now familiar illustration afforded by the binocular stereoscope, how very dissimilar were the pictures of the same object received by small lenses placed as near as the two pupils of the human eye—images so distinct that a child could readily distinguish them; and yet multitudes of such images were all received and jumbled together in those photographic pictures where lenses or mirrors of that or larger—say three or four inches—apertures were used. "The photographer, therefore," said Sir David Brewster, "who has a genuine interest in the perfection of his art, will, by accelerating the photographic processes with the aid of more sensitive materials, be able to make use of lenses of very small aperture, and thus place his art in a higher position than that which it has yet attained. The photographer, on the contrary, whose interests bribe him to forswear even the truths of science, will continue to deform the youth and beauty that may in ignorance repair to his studio, adding scowls and wrinkles to the noble forms of manhood, and giving to a fresh and vigorous age the aspects of departing or departed life." He then produced an exact diagram of photographic images of a simple object produced by Mr. Buckle of Peterborough, whose Talbotypes obtained a Council medal at the Great Exhibition. The acting diameter of the lens was 3½ inches; and by using it with all covered, except a central space of 2-10ths of an inch diameter, and then along with this space exposing circular spaces of the same size towards the outer circumference of the aperture, the effect of the combination of the marginal pictures was most distinctly exhibited and demonstrated, by haloes extending round the true image, and the sharp cross lines ruled on the object, and shown in the image with the small lens, but all confused in that with the surrounding apertures.

"On an Account of a Rock-Crystal Lens and Decomposed Glass found in Nineveh," by Sir David Brewster.—Sir David said that he had to bring before the Section an object of so incredible a nature, that nothing short of the strongest evidence was necessary to render the statement at all probable. It was no less than the finding in the treasure-house at Nineveh of a rock-crystal lens, where it had for centuries lain entombed in the ruins of that once magnificent city. It was found in company with several bronzes and other objects of value. He had examined the lens with the greatest care, and taken its several measurements. It was not entirely circular in its aperture, being 1 6-10ths inches in its longer diameter, and 1 4-10ths inches in its shorter. Its general form was that of a plano-concave lens, the plane side having been formed of one of the original faces of the six-sided crystal of quartz, as he had ascertained by its action on polarized light—this was badly polished and scratched. The convex face of the lens had not been ground in a dish-shaped tool in the manner in which lenses are now formed, but was shaped on the lapidary's wheel, or in some such manner. Hence it was unequally thick, but its extreme thickness was 2-10ths of an inch, its focal length being 4½ inches. It had twelve remains of cavities which had originally contained liquids or condensed gases; but ten of these had been opened probably in the rough handling which it received in the act of being ground; most of them, therefore, had discharged their gaseous contents. Sir David concluded by assigning reasons why this could not be looked on as an ornament, but a true optical lens.

Sir David then exhibited specimens of the decomposed glass found in the same ruins. The surface of this was covered with iridescent spots, more brilliant in their colours than peacock copper ore. Sir David stated that he had several years since explained how this process of decomposition proceeded, on the occasion of having found a piece of decomposed glass at St. Leonard's. It had contained manganese, which had separated from the silex of the glass, at central spots round which circles of most minute crystals of true quartz had arranged themselves; bounded by irregular jagged circles of manganese, these being arranged in several concentric rings. When this process reached a certain depth in the glass it spread off laterally, dividing the glass into very thin layers, and new centres seemed to form at certain distances, and thus the process extended.

"On a Peculiarity of Vision," "On Converging Sunbeams," and "On Luminous Beams," by Professor Powell.

Saturday.

"Report of Experiments on the Laws of the Conduction of Heat," by Professor J. D. Forbes. Experiments have been altogether suspended since the last report, by the severe illness of Professor Forbes. The result is this, that in the case of iron (the only one yet tried) the flux of heat through the solid is not in a simple direct proportion to the difference of temperature of two contiguous thin slices, but varies in a less rapid proportion; or, the conductivity diminishes as the temperature increases.

"On the Laws of Magnetism and Diamagnetism," by Professor Matteucci.

"On the Connection between Geological Theories and the Figure of the Earth," by Mr. H. Hennessey.

Sir D. Brewster gave a description of a new and simple Polariscope, which, however, could not be made intelligible without diagrams.

"On some New Phenomena of Diffraction," by Sir D. Brewster.

"On a Manifold Binocular Camera," by A. Claudet. The author exhibited a double camera, for taking the two stereoscopic daguerreotypes of groups or individuals, and by which four double pictures could be successively taken with such rapidity as to be exact representations of the same circumstances. It would be impossible to make all the mechanical arrangements of this instrument intelligible without drawings. The author also exhibited an instrument, which he called a stereoscopeometer; by which he could accurately measure the angles, by which could be determined the place of the group or figure to be taken, and the position in every one of their adjustments of the double camera and its slides.

"On an Instrument for obtaining correct Representations of Objects from Nature," by H. Twining. This little instrument was on the principle of a theodolite; by which the angular positions of the several objects in a scene in nature, which the artist had resolved to transfer to his canvas, could be accurately recorded in his note-book, and afterwards at leisure, by the aid of a square frame of crossing threads accurately placed in a picture of any determined size, according to certain simple rules, which the author pointed out.

"On the Equilibrium of Elongated Masses of Ferro-magnetic Substances in uniform or varied fields of view," by Professor W. Thomson.

"On Poisson's Theoretic Anticipation of Magneto-crystallic Action," by Dr. Tyndall.

MONDAY.

Communication from the Smithsonian Institution, "On the Plan adopted for investigating the Meteorology of North America."

"On Dove's Map of Abnormal Temperature of the Globe," by Colonel Sabine.

Colonel Sykes commented on "An Analysis of Official Returns of Medical Officers to the Medical Board in Calcutta, from 127 Stations in the Bengal Presidency, on the daily Mean Temperature and Fall of Rain at those Stations during 1850."

Colonel Sykes communicated extracts from a letter from Dr. G. Buist. "On four simultaneous Experiments in the Island of Bombay, to determine the Fall of Rain at different Heights below 200 feet."

"On Atmospheric Daily and Yearly Fluctuations," by Dr. G. Buist.

"General Results of Observations during Two Balloon Ascents, made under the Superintendence of the Kew Committee of the British Association," by John Welsh, Esq.

"Notes on the Meteorology of Ireland, deduced from the Observations made at the Coast Guard Stations, under the direction of the Royal Irish Academy," by the Rev. Dr. Lloyd.

"On Tropical Hurricanes," by Dr. J. Taylor.

"On the Meteorology of Birmingham," by William Wells.

"Meteorological Summary for 1851, at Huggate, near Pocklington," by the Rev. T. Rankine.

TUESDAY.

"On a New Effect produced on Muscles by the Electric Current," by Dr. E. Du Bois Reymond.

"The Ninth Annual Report concerning the Kew Observatory," by F. Ronalds.

"Provisional Report on the Reduction of Anemometrical Observations," by Sir W. Snow Harris.

"On the Placing of Compasses in Iron Ships," by Capt. E. J. Johnson. While the *Trident* was in the basin at Woolwich, it occurred to me to try whether a position could be discovered where the influences of the ship's iron upon the compass were so equalized, as to render the amount of deviation so small as to be of no practical importance. The correct magnetic direction of the ship's head having been determined by a compass on the shore, and that proving to be near to one of the points of maximum deviation, (the standard compass on the quarter-deck there indicating 20° *westerly* deviation,) I moved the standard compass several feet further *forward* in the centre line of the ship, and there found the *westerly* deviation increased to 29°. I now commenced to move the compass aft six or seven feet at a time, observing the deviation at each position, and found the *westerly* deviation *decreased*; and on placing the tripod of the compass directly over the rudder-head, *easterly* deviation was produced; and hence it followed, that there must be a position somewhere between the last two places of observation where there would be no deviation while the ship's head remained in the same direction. This position I practically discovered by moving the compass a few inches at a time, till it indicated the correct magnetic direction of the ship's head. The question which now remained to be proved was, to what extent the deviations of the said compass had been lessened (or what they actually were) when the ship's head was placed upon different points; and I was gratified to find, that after swinging the vessel, and observing upon the eight principal points, the compass placed as before described proved to be correct within a quarter of a point. It is necessary to mention that the *Trident* has wooden beams under the quarter-deck, and therefore it remains to be seen to what extent such observations may be useful in vessels which have iron beams. It will also be requisite to ascertain, by actual observation, how far a position so selected shall prove advantageous when the ship changes her geographical position; and as the *Trident* is about to proceed to the southern hemisphere, and is amply provided with instructions and the means of ascertaining such changes, and as I shall swing her again at Greenhithe, on every point, before she leaves, we may hope for much useful information on this important subject. I must observe, that it may not always be practicable to find the position of no deviation, or where the influences of the iron in the ship upon the magnetic needle are equalized, because such a point might be found in a most convenient position, or be too near moveable ironwork, machinery, &c.; but if we succeed in approximating towards it, and thereby reduce the deviations within moderate limits, a point of great practical importance will be gained in navigation.

"On the Formula for the Wet-bulb Thermometer," by Capt. Strachey.

"On Biquaternions," by Sir W. R. Hamilton.

"On the Optical Properties of a recently-discovered Salt of Quinine," by Prof. Stokes.

"On an Improved Form of Reflecting Instrument for Use at Sea," by Professor C. P. Smyth. The peculiar circumstances of an observer at sea, caused chiefly by the rolling of the vessel, preclude the use of any of the ordinary instruments employed on land for measuring altitudes, depending, as they do, on levels or plumb-lines for their zero points. Recourse must be had to the principle of double images, by two reflectors, the method invented by Hadley and Newton. This one necessary principle has been carried out in a variety of different forms, in the sextant, quadrant, quintant, or a reflecting circle, some more or less accurate or more or less convenient than others; but all of them, under whatever names they are known, are merely different forms of essentially the same instrument. Great ingenuity has been shown in many of their forms; but still the greatest degree of efficiency has not yet been arrived at, or the highest degree of convenience for all the various occasions required in practice. The ordinary form of the reflecting instrument at present in use is the sextant, in which will generally be found, even as made by the best makers, more or less of practical drawbacks—which the Professor enumerated—upon the speedy and accurate employment of it. The author then exhibited a reflecting instrument which he had had constructed by Messrs. Adie, of Edinburgh, and which appeared to supply all the desiderata; for it was in the shape of a circle, small, light, and simple, with the delicate parts protected from injury under all circumstances; the usual *loose* telescope and plain tubes were avoided, by making them cross through each other and work on a pivot, thus admitting of instant alteration from one to the other; the illuminating apparatus was improved, and rendered powerfully effective even with a faint light, and a small apparatus was added, which, without sensibly cumbering the instrument, gave, either by day or by night, a convenient horizontal referring point, visible in the field of view.

"On an Instrument for exhibiting the Colours of Liquids by Transmitted Light," by R. W. Townshend.

"Examination of Dove's Theory of Lustre," by Sir David Brewster.

"Notice of a Tree Struck by Lightning in Clandeboye Park," by Sir David Brewster.

"Results of Hourly Observations of Barometer and Thermometer at Saharunpore, in the North-West of India, lat. 30°," by Dr. F. J. Royle.

"On a New Thermometer of Contact, and certain Results obtained by it," by Dr. Tyndall.

"On Chinese Arithmetical Notation," by the Rev. R. J. Bryce.

"On Criteria for Real and Imaginary Roots of Biquadratic Equations," by W. Gartland.

"On the Stereoscopeometer," by A. Claudet. This was a simple instrument, by which the relative positions of the two cameras, and the placing of the object, could be accurately determined in taking the pictures for the binocular stereoscope.

"On the Aurora Borealis," by Admiral Sir John Ross.

"On the Aurora," by Lieut. W. H. H. Hooper.

"Aurora Borealis observed at St. Ives, Hants," by J. K. Watts.

SECTION B.—CHEMICAL SCIENCE.

SATURDAY.

"On the Effect of the Moon's Rays," by Mr. Knox.

"On the Atomic Weight of Magnesium," by Mr. A. Macdonnell.

"On the Sources of Common Salt," by Mr. W. Bollaert.

MONDAY.

"On the Principle of the Endosmose of Liquids," by Professor Graham, F.R.S.

"On the Composition and Microscopic Structure of certain Basaltic and Metamorphic Rocks, and particularly on the Occurrence in them of Iron in the Metallic State as a diffused Constituent," by Dr. Andrews.

"On the Application of certain Optical Phenomena to Chemistry," by Professor Stokes.

"Is Mechanical Power capable of being obtained by a given amount of Caloric employed in the Production of Vapour, independent of the nature of the Liquid?" by Dr. Apjohn.

"On Irish Bog Butter," by J. A. Brazier.

TUESDAY.

"Report on the Influence of Solar Radiations," by Mr. R. Hunt.

"Notice of the Oil of the Sun-fish taken off the Bay of Galway," by Dr. Ronalds. The system of taking these fish by the Claddagh fishermen is similar to that of whale-fishing in the Arctic Seas. In attacking them, a rude kind of harpoon is used, the barb of which is far from the point, and, consequently, the force requisite to strike it to a sufficient depth into the animal is so great, that during the season only eight or ten are killed. The blubber of one fish amounts to about 120 gallons. This yields an oil of a light yellow colour, and purely transparent. About 70 per cent. of oil can be obtained; and when a more careful process is used, the yield of oil may amount to 81 per cent. This oil is remarkable for its low specific gravity, varying from ·874 to ·879; whilst sperm oil, considered the lightest, has a specific gravity of ·881, and the gravity of whale oil is generally found to be from ·911 to ·922. In an argand or study lamp, it burns with a brilliancy which appears, to the eye at least, as bright as the best vegetable lamp oils. As yet the fishermen cannot procure a higher price for it than that usually paid for the common fish oil. Alcohol, having a specific gravity of ·820, dissolves a considerable quantity of it; and when treated with a small amount of sulphuric acid, extreme heat is evolved. The crude oil is composed of C 82·77, H 12·99, O 4·27, and its composition when purified is similar. The amount of oxygen here is wonderfully small, which is another peculiarity in this oil as compared with others. Its atomic weight is 7·5.

"On the Composition of Food in Relation to Respiration and the Feeding of Animals," by J. B. Lawes, Esq., and Dr. J. H. Gilbert.

"On the Phosphatic Nodules of the Greensand of the North of Ireland," by Dr. Hodges.

"On the Estimation of Iodine," by Dr. Penny.

"On the Koh-i-noor Diamond," by Professor Tennant.

"On Glynn and Appel's Patent Paper for the Prevention of Piracy and Forgery by the Anastatic Process," by S. Bateson, Esq.

"On Chemical Combination," by Dr. T. Wood.
"On Combinations of Metals with Oxygen," by Dr. T. Wood.
"On the Composition and Economy of the Flax Crop," by Professor Hodges.

Section C.—Geology and Physical Geography.

The proceedings commenced by the exhibition of the new Geological Map of Ireland, prepared by Mr. Griffith under the British Association.

"On the Geology of St. Ives, Huntingdonshire," by Mr. J. K. Watts.

"On the Mines of Copiapo," by Colonel Lloyd.

"On the Lower Members of the Carboniferous Series of Ireland," by Mr. Griffith.

"On the Devonian Rocks of the South of Ireland," by Mr. Jukes.

"On the Fossils of the Yellow Sandstone of the South of Ireland," by Professor Forbes.

"On the Lowest Fossiliferous Beds of North Wales," by Mr. Salter.

"On new Genera of Irish Silurian Fossils," read by Professor M'Coy.

"On the Discovery of Borings of a Parasitical Animal in a Fish-scale found in Chalk," by Mr. C. B. Rose.

Section F.—Statistics.

Saturday.

"The Laws of the Currency in Ireland exemplified in the Changes that have taken place in the Circulation of Bank Notes in Ireland since the Act of 1845," by J. W. Gilbart, Esq.

"Statistics of the Revenues of the University and some of the Colleges of Oxford, compiled from the Report of the Oxford University Commission," by James Heywood, Esq., M.P.

"A notice of the Progress of the Sewed Muslin Manufacture in Ireland," communicated by Mr. Holden, and read by Professor Hancock. It stated that the trade was introduced into Ireland between 1800 and 1810, but little progress was made with it until the period between 1820 and 1830. The introduction of lithographic printing between 1830 and 1835, instead of the old block system, was one of the most important elements in firmly establishing the trade. The old blocks cost from 8s. 6d. for simple patterns, to £6 or £7 for more intricate, besides the time (two or three weeks) occupied in the preparation of the patterns, and cutting them upon the blocks, whilst they could now be produced in a few hours at about the same amount of shillings as it formerly cost pounds. So extensively had the business increased during the last fifteen years, that there was now employed in Ulster, and other parts of Ireland, nearly a quarter of a million individuals. The wages of the young persons was, when they first commenced, only from 6d. to 1s. per week—the more experienced obtained 4s. to 6s., and a few first-class workers 10s.; and there was now paid between £500,000 and £600,000 per annum for the manufacture, exclusive of the cost of the materials; and moreover, the employment was afforded in the best manner, being given to young females at their own homes, under the supervision of their parents. A great deal of good had also been effected by the establishment of training-schools for teaching the embroidery, and the landed proprietors had been very forward in establishing those schools. Amongst others, the Earl and Countess of Enniskillen established one of these schools; and the result was, that the females of Enniskillen were now earning, from embroidery, no less than £400 a week. The Irish manufacture was rapidly growing into importance, and, despite of fiscal arrangements, was making great way on the Continent; even in France, where the import of goods of this description was interdicted, a large quantity obtained admission by smuggling.

In reply to questions, Mr. Holden stated that they now used zinc plates instead of stones for the purpose of printing the patterns, as it was found to be much cleaner. He had received a great many additional orders since the Great Exhibition, but whether it resulted from that cause he could not tell. Amongst others, he had recently received orders from Spain and Germany.

"Statistics of the Island of Portsea," communicated by the Literary and Philosophical Society of Portsea. A mass of documents, giving minute particulars of the results of laborious inquiries into nearly every subject connected with that locality.

Monday.

"On the present State of the Law of Settlement and Removal of Paupers in Scotland," by Dr. Alison.

"Should our Gold Standard of Value be maintained, if Gold becomes depreciated in consequence of its discovery in Australia and California?" by Professor Hancock.

"Statistics of the Deaf and Dumb in Ireland," by Mr. Wilde.

Tuesday.

"On the Connection of Atmospheric Impurity with Disease," by Dr. H. M'Cormac.

"On some Results drawn from the Sanitary Condition of Belfast," by Dr. Malcolm.

"On the Progress and Extent of Steamboat Building in the Clyde," by Dr. Strang. No business, during the last fifty years, had exhibited so much progress in the west of Scotland as that of steamboat building. It was a manufacture of home production; the materials being within themselves, and requiring skill in every department, the remuneration was higher than in the ordinary manufactures of the country—it, in fact, created the districts in which it was established, and gave constant employment to the industrious. It was just forty years since the *Comet* made its first trip from Glasgow to Greenock. The *Comet* was only 30 tons burthen, and its engine was but 3 horse power. Dr. Strang then proceeded to trace the different forms in which steam vessels had been built, and paid a just tribute to Henry Bell, the first man who rendered steam available for navigation purposes. In reference to the progress of the trade of steamboat building on the Clyde, he showed that, in the year ending June, 1852, the number and tonnage of steamers engaged in traffic on the Clyde were 93 vessels, of 11,992 tons; the increase on regularly employed vessels on the river was 26, and in tonnage, 5,301 tons. But that gave no idea of the magnitude of the steamboat building, and marine engine making. During the last seven years there have been constructed, or are constructing, in Glasgow and neighbourhood, 123 vessels, 122 of which were iron, 80 paddle, and 43 screw, consisting of 200 wooden tonnage, 70,441 iron tonnage 6,610 horse power engines for wooden hulls, 22,539 horse power for iron hulls, and 4,720 horse power engines for vessels not built on the Clyde. At Dumbarton, during the last seven years, there have been constructed, or are constructing, 66 steam vessels, 13 of which are wood and 53 of iron, 25 being paddles and 41 screws; the gross tonnage being 47,202 tons. It would be seen that the wooden hulls are fast giving place to those of iron, and the screw is more patronized than the paddle. The proportion in 1852 was 73 iron against 4 of wood, and of screws to paddles it is as 48 to 30. Dr. Strang then exhibited the amount of money expended in this branch of trade, and the quantity of employment it gives. Both were enormous, —taking the last seven years of building on the Clyde at £4,650,652, and the employed, at Dumbarton, Greenock, Port-Glasgow, and Glasgow, at 10,820 persons at annual wages of £450,112.

Professor Ingram read a few extracts from a paper, entitled "A Short Account of the Early Bills of Mortality in Dublin," by Mr. W. A. Wilde.

Section G.—Mechanical Science.

Saturday.

"On the Jet Pump," by Mr. J. Thomson. The author stated that the purpose for which the instrument is designed, is, to clear the water out of the pits of submerged water-wheels, when access to them is required for inspection or repairs. For this special purpose, it was likely to prove very useful. A drawing and model exhibited rendered its construction easy of explanation. The action of the jet pump depended on two principles. One is the same as that of the steam-blast used in locomotive engines and in the ventilation of mines. The other is one which was known to the ancient Romans, and was used sometimes by them for drawing off more water from the public pipes than they paid for.

"On Vortex Water-Wheels," by Mr. J. Thomson. The subject is a new variety of the general class of water-wheels called turbines. In this machine the moving wheel is placed within a chamber of a nearly circular form. The water is injected into the chamber tangentically at the circumference, and thus it receives a rapid motion of rotation. Retaining this motion, it passes onwards towards the centre, where alone it is free to make its exit. The wheel, which is placed within the chamber, and which almost entirely fills it, is divided by thin partitions into a great number of radiating passages. Through these passages the water must flow on its course towards the centre, and in doing so it imparts its own rotatory motion to the wheel. The whirlpool of water acting within the wheel chamber, being one principal feature of this turbine, leads to the name "vortex" as a suitable designation for the machine as a whole. The velocity of the circumference is made the same as the velocity of the entering water, and thus there is no impact between the water and the wheel; but, on the contrary, the water enters the radiating conduits of the wheel gently—that is to say, with scarcely any motion in relation to their mouths. In order to attain the equalization of these velocities, it is necessary that the circumference of the wheel should move with the velocity which a heavy body would attain in falling through a vertical space equal to half the vertical fall of the water, or, in other words, with the velocity *due* to half the fall; and that the orifices through which the water is injected into the wheel chamber should be conjointly of such area, that when all the water required is flowing through them, it also may have a velocity due to half the fall. Thus one-half only of the fall is employed in producing velocity in the water; and, therefore, the other half still remains acting on the water within the wheel chamber at the circumference of the wheel in the condition of fluid pressure. Now, with the velocity already assigned to the wheel, it is found that this fluid pressure is exactly that which is requisite to overcome the centrifugal force of the water in the wheel, and to bring the water to a state of rest at its exit, the mechanical work due to both halves of the fall being transferred to the wheel during the combined action of the moving water and the moving wheel. The effects of friction, and of some other modifying influences, are, for simplicity, left out of consideration; but in the practical application of the principles they must be taken into account. Mr. Thomson exhibited a model of the machine, together with a number of drawings illustrative of its several varieties of form and manner of construction.

A discussion took place on the properties of Mr. Thomson's invention in the case of the vortex wheel; Mr. Appold contending that its power would be small in comparison with what was stated by Mr. Thomson, and that its expense would not be any great improvement on the principles for the same end at present in use; while, on the other hand, Mr. Webster, Dr. Robinson, and the Chairman believed that the invention was a great addition to mechanical science.

"Remarks on the Minie Rifle," by Mr. Fairbairn. Mr. Fairbairn observed that, until of late years, all the gun barrels for the army, and other descriptions, had to be welded upon mandrils, some of them formed by a bar of iron rolled upon the mandril, in a spiral direction, and then welded by repeated beatings from the muzzle to the breech. Others were differently constructed, by welding the bars longitudinally, in the line of the barrel, and not in the spiral direction adopted in the former process. Now the whole is welded at one heat, and that through a series of grooves in the iron rollers, specially adapted for the purpose. This, with other

improvements, has rendered the manufacture of rifles and other arms a matter of much greater certainty and security than at any former period. Admitting the advantages peculiar to this manufacture, it does not, however, affect the principle of the rifle itself, in which there is no alteration, but in every respect similar, even to the spiral grooves, which, I believe, are not altered, but are the same as in the old rifle. This being the case, it has been a question of much interest to know wherein consists the great difference in the practice with the new rifle, as compared with that of the old one. It is not in the gun, and must, therefore, be in the ball, or that part of the charge which generates the projectile force. But, in fact, the improvement consists entirely in the form of the ball, which is made conical, with a hollow recess at the base, into which a metallic plug is thrust by the discharge. The plug is so constructed as that, when driven into the ball, it compresses the outer edges against the sides of the barrel, and, at the same time, forces a portion of the lead, from its ductility, to enter the groove, and to give the ball, when discharged, that revolving motion which carries with it such unerring certainty to the mark. In the practice which I witnessed with one of those rifles, on the marshes at Woolwich, the following results were obtained:—Out of twelve rounds, at a distance of 700 yards, as near as I can remember, only one bullet missed the target, and the remaining eleven rounds were scattered within distances of about six inches to four feet from the bull's eye. At 800 yards three shots missed the target, and the remaining nine went through the boards, two inches thick, and lodged themselves in the mounds behind, at a distance of about twenty yards. The same results were obtained from a distance of 900 yards, and at 1000 yards there were very few of the bullets but what entered the target. In these experiments I have to remind you that the end of the rifle was supported upon a triangular standard, and the greatest precision was observed in fixing the sight, which is graduated to a scale in the ratio of the distance, varying from 100 to 1000 yards, which latter may be considered the range of this destructive instrument.

Mr. Alfred J. Woodhouse "On the Mould for Casting Conical Bullets."

"New Tubular Boiler," by Mr. Fairbairn. This subject was illustrated by tables and diagrams. The new boiler consists of two furnaces the same as the double-flue boiler, but with this difference, that the cylindrical flues which contain the grate bars are united at a distance of eight feet from the front of the boiler into a circular flue, which forms the mixing chamber, and which terminates in a disc plate, which contains a series of three-inch tubes, eight feet long, and similar to the locomotive boiler. These tubes, in a boiler seven feet diameter, are 104 to 110 in number, and, from the thinness of the metal, become the absorbents of the surplus heat escaping from the mixing chamber and the furnace. On this principle of rapid conduction, the whole of the heat, excepting only what is necessary to maintain the draught, is transmitted into the boiler, and hence follows the economy of entirely dispensing with brick-work and flues—an important desideratum in those constructions.

Mr. J. Barton "On the Permanent Way of Railways." This paper referred to the general experience of railways of great traffic.

Mr. Godwin "On an Improved Cast-Iron Sleeper for Railways." The improvement which Mr. Godwin suggests, consists in substituting a cast-iron chair and sleeper for the permanent way of railways, in cases where, from the decay of the wood sleeper, it may be necessary to reconstruct the line. The fastening of the rail to the sleeper is the main feature in the invention, and consists in driving a cast-iron wedge between the rail and the chair, forcing the rail upwards, and thus producing a simple and permanent fastening. Models were exhibited. Mr. Godwin suggested, as a further security against the wedges shaking loose, that they may be driven in with sal-ammoniac, and thus insure an immoveable and permanent line of road.

Monday.

"On Improvements made in the Harbour of Belfast," by Robert Garrett, Esq. This paper described the situation of the town of Belfast on the River Lagan, at its junction with that extensive inlet known as Belfast Lough, and stated that the courses of the tides do not tend to the formation of the shoals and bars so formidable at many harbour entrances. It appears there are 14 miles square of good anchorage ground, and from 2 to 10 fathoms of water. The particulars of the river and the lough, and the various engineering additions for accommodation, were then detailed—from 1720, when the first quay wall was built, and 1785, which marked the commencement of the progress which has continued to the present time. The suggestions, improvements, and works of Messrs. Rennie, Telford, Walker, Burgess, and Mr. Smith, the resident engineer to the Harbour Commissioners, were described, and a discussion ensued, wherein W. Webster, Mr. Garrett, Mr. Appold, Mr. Godwin, and the chairman, Mr. Walker, took part.

"Mechanical Proof of the Composition of Rotatory Forces," by John Barker, M.B. This was an apparatus constructed for the purpose of exhibition and demonstration of these powers.

"A Series of Observations on the Discharge of Water from Actual Experiment," by Mr. J. F. Bateman. Mr. Bateman stated that his experiments proved the accuracy of formulæ established by Chevalier Dubuet, for calculating the mean velocity of water in the separate channels.

Tuesday.

"On Penrose and Bennett's Sliding Helicograph," communicated by Professor C. Piazzi Smyth. The author observed, "I was led, during my researches on the subject of the refined curves of the Greek mouldings and ornaments, to consider whether it would be possible to contrive some method of describing the volutes and scroll-work at once more ready and more satisfactory than the tiresome approximations, by means of circular ones, which have generally been used. I invented an instrument for this purpose, called the Screw Helicograph. This instrument has been elaborated into the improved form now exhibited. By simply turning round the graduated ring within the square frame, this instrument is enabled to draw in pencil or ink any form of the equiangular spiral from the circle to the straight line; and, by alterations in the position of the pen, or of the centre, with respect to the guide bar, certain variations may be obtained. Also, either a parallel line to the first may be drawn by a simple adjustment of the pen, or a duly converging line, by bringing the whole frame nearer to or farther from the centre. Expressing the ratio between two spiral radii at an interval of 360° (*viz.*, $a^{2\pi}$) by the term '*spiral ratio*,' it appears that curves drawn by this instrument, with spiral ratios less than 8 or 10 to 1, are fitted for volutes and scroll-work, and those which are drawn with higher ratios for the outlines of vases and other such figures where a *gentle variation of curvature* is desired. This quality is insured from the property of the curve, that the radius of curvature is proportional to the length of the arc. For figures where great energy is required, curves of a different nature are more suitable, but no curves appear to surpass these in sweetness of sequence."

"An Account of the Drainage of the Middle Level of the Bedford Level, with Observations on Arterial Drainage," by James Cooper.

"On some Properties of Whirling Fluids, with their Application in Improving the Action of Blowing Fans, Centrifugal Pumps, and certain kinds of Turbines," by James Thomson. He pointed out several curious and interesting properties possessed by masses of fluids revolving in the circumstances of one of the most ordinary kinds of whirlpools—that, namely, which is formed when water is supplied at the circumference of a widely-extended vessel, and is allowed to flow away by a central orifice in the bottom. He showed that a consideration of these properties led to the conclusion, that the efficiency of centrifugal pumps, of fans for causing blasts of air, and of turbines discharging the water at the circumference, may be greatly increased by the provision, outside of the wheel, of a space in which the water may continue to revolve, without any interruption, after it has left the wheel. He stated that he had reason to believe that the centrifugal pump of Mr. Appold was so constructed as to take advantage of this principle; and added, that to this, its superiority over other centrifugal pumps appeared to him to be in a great degree due. He mentioned that an apparatus involving the same principle has been applied, with good results, in turbines of great power constructed in America.

"Remarks on the Mechanical Process for Cooling Air in Tropical Climates proposed by Professor C. Piazzi Smyth," by W. J. M. Rankine. The most improved form of the apparatus proposed by Prof. Smyth consists—1. Of a Compressing Pump, by which the air is to be forced into—2. a Refrigerator, consisting of a long tube, or a series of tubes, exposed to a stream of water, in which the air will be deprived of the heat generated by the compression, and from which it will escape into—3. an Expansion Cylinder, in which the air will at once become cooled by expansion to an extent nearly, but not quite, equal to that of the original heating by compression, and will propel a piston to assist in working the compressing pump. The air will be delivered from this expansion cylinder into the building to be ventilated. The principal resistance to be overcome in this improved machine will be the friction. The author gives formulæ and rules for calculating the dimensions of the parts of this machine, and the power required to work it, supposing the friction to be known. It is difficult to estimate the amount of friction beforehand; but supposing it to be a little greater in proportion than that of a Cornish pumping-engine, the author calculates that about 25,000 cubic feet of air per hour may be cooled down from 90° Fahr. to 60° by an engine of 1 horse power. Without the expansion cylinder, the amount of air so cooled would be only from 8,000 to 9,000 cubic feet per hour by the same engine, and it would not be so effectually done. This method of cooling air has lately been found to succeed very well in a mine in South Wales, even with very imperfect apparatus.

"On the Production of Cold by Mechanical Means," by Mr. W. S. Ward. To effect the same purposes named in the foregoing paper, Mr. Ward proposes a different method, and the substitution of the vapours of volatile liquids—such as sulphuric ether in place of air. He believed the theoretical results would be the same, and some sources of loss diminished; but although he doubted whether either form of apparatus would be economically efficient, he felt that interesting results would follow well-conducted experiments on the subject.

"On the Natural Peculiarities and Advantages of the Mineral Field and the proposed Harbour of Fair Head," by Mr. W. H. Smith. This was a proposal to erect a harbour at Fair Head, the extreme point on the north-eastern coast of Ireland, and establish a submarine telegraph between it and the Mull of Cantyre, which is only twelve miles distant on the Scottish coast, and is the principal point to Glasgow. Having pointed out the immense variety of mineral wealth and natural products, consisting of coal, iron, sulphur, copperas, ochre, building and lime stone, and other valuable substances which abounded in the district, but could not be turned to full advantage in consequence of the want of a harbour—while shipwrecks on the coast have occurred annually since the old harbour of Ballycastle adjoining was allowed to fall to decay,—the Report stated, that a harbour at Fair Head would be a permanent protection to shipping, and besides increasing the spirit of commercial enterprise, would, in some cases, be the means of shortening the passage to America by several days. The harbour was proposed to be constructed on the recoil principle, being formed of a framework fastened to piles, with counterbalancing weights attached, so that it would yield to the waves, and yet recover its position continually. A lighthouse on the same principle was proposed to be attached.

A Model of a New Reaping Machine, by Mr. R. Robinson, was exhibited, after the Sectional meeting, by one of the Secretaries, and gave rise to much conversation on the subject of reaping machines.

"On a Dynamometric Machine for Measuring the Strength of Textile Fabrics, and other Substances," by M. Perreaux.

MONTHLY NOTES.

THE SOCIETY OF ARTS AND THE GREAT EXHIBITION.—With that laudable energy which has, in late years, characterised the movements of the Society of Arts, the Council have issued the following address, indicative of their strong feeling as to the results to be worked out of the impression made by the Exhibition:—"The Council are of opinion that the Great Exhibition, with the origin of which the Society has so honourable a connection, ought not to pass away without some attempt being made to preserve and perpetuate those results which have already arisen out of that great event; and they are strengthened in this view by the desire which the President of the Society has expressed, that the Council should systematise a mode by which the immediate practical results of the Exhibition may be brought before the public. The entire willingness which has been manifested by eminent persons, of all nations and all grades of society, to meet together in harmonious co-operation, and promote the great objects which give the Society its name—namely, the progress of arts, manufactures, and commerce, and on behalf of which the Society was instituted a century ago, is one of the best results of the Exhibition; and it appears to the Council that this great good ought not to be permitted to die with the close of the Exhibition. With this view the Society has already revised its bye-laws, and enacted, that in future the committees of the Society shall be formed for the following classes, corresponding with the thirty classes of the Exhibition; each committee to consist of three members, one of whom will be appointed as the reporter.

1. Mining, quarrying, metallurgical operations, and mineral products.
2. Chemical and pharmaceutical processes and products generally.
3. Substances used as food.
4. Vegetable and animal substances chiefly used in manufactures, as implements or for ornament.
5. Machines for direct use, including carriages and railway and naval mechanism.
6. Manufacturing machines and tools.
7. Civil engineering, architectural and building contrivances.
8. Naval architecture and military engineering; ordnance, armour, and accoutrements.
9. Agricultural and horticultural machines and implements.
10. Philosophical instruments, and processes depending upon their use; musical, horological, and surgical instruments.
11. Cotton.
12. Woollen.
13. Silk and velvet.
14. Manufactures from flax and hemp.
15. Mixed fabrics, including worsted fabrics and shawls.
16. Leather, including saddlery and harness; skin, fur, feathers, and hair.
17. Paper and stationery, printing and bookbinding.
18. Woven, spun, felted, and laid fabrics, as specimens of printing or dyeing.
19. Tapestry, including carpets and floor-cloth, lace and embroidery, fancy and industrial works.
20. Articles of clothing for immediate personal or domestic use.
21. Cutlery and edge-tools.
22. Iron and general hardware.
23. Working in precious metals, and in their imitation; jewellery, and all articles of vertu and luxury not included in the other classes.
24. Glass.
25. Ceramic manufacture, china, porcelain, earthenware, &c.
26. Decoration, furniture, and upholstery, including paper-hangings, papier-maché, and japanned goods.
27. Manufactures in mineral substances used for building and decoration, as in marble, slate, porphyries, cements, artificial stone, &c.
28. Manufactures from animal and vegetable substances, not being woven or felted, or included in other sections.
29. Miscellaneous manufactures & small wares.
30. (a) Sculpture, models, and plastic art.
    (b) Painting.
    (c) Architecture.
    (d) Stained glass, enamels, mosaics, and miscellaneous.

"It will be the business of each committee to collect facts, both from abroad and at home, relative to its class of objects, and publish the results. By this means it is hoped to present to all who may be interested in the progress of arts, manufactures, and commerce throughout the world, a summary of their existing state and progress, as well as an examination of the most interesting topics that affect them. The Council, therefore, seek the co-operation of the jurors, the foreign and local commissioners, exhibitors, and members of local committees, who are not already members of the Society, and invite their assistance in carrying into effect the objects of the proposed committees. The forms, &c., necessary to be observed by those who desire to become members of the Society of Arts, and the privileges conferred by membership, may be learnt of the Secretary, at the Society's House, Adelphi, London. The Council venture to recommend that those of the foreign commissioners and jurors who may concur in this suggestion, should associate themselves in their respective countries as foreign corresponding committees of the Society of Arts; and that, in like manner, the exhibitors and members of the local committees of the United Kingdom should constitute themselves local committees of the Society of Arts, for the purpose of collecting and communicating useful information, calculated to promote the progress of arts, manufactures, and commerce."

GOVERNMENT SCHOOL OF MINES AND OF SCIENCE APPLIED TO THE ARTS.—The session will commence on Wednesday, the 3d of November, at three o'clock, with an introductory address by Dr. Playfair, who has been appointed to superintend the classes in chemistry, as applied to the arts and agriculture. Mr. Edward Forbes will continue his course of lectures on natural history; Mr. Robert Hunt, on mechanical science, with its application to mining. Dr. John Percy will give courses in metallurgy, with its special applications; while instruction in geology is to be intrusted to Mr. A. C. Ramsay; and mining and mineralogy to Mr. Warington W. Smith. The authorities have published a prospectus, which may be obtained, gratis, on application at the Museum of Practical Geology, in Jermyn Street. The prospectus contains an appendix, giving the questions in chemistry, natural history, mechanical science, and mineralogy, submitted to the students at the examination for honours in May last, and which indicate the high and important character of the studies pursued.

THE EXPERIMENTAL SQUADRON OF SCREW STEAMERS.—Since we published our report of the performances of these vessels last year, they have gone through seven competing trials, of which the following is a summary. We may remind our readers that the squadron consists of the Arrogant, 40, Captain Robinson (senior officer), 360-horse power; Dauntless, 24, Captain Halstead, 580-horse power; Highflyer, 21, Captain Matson, 250-horse power; and Encounter, 14, Captain Gordon, 360-horse power:—

RESULTS.	ARROGANT.	DAUNTLESS.	HIGHFLYER.	ENCOUNTER.	REMARKS.
	YDS.	YDS.	YDS.	YDS.	
Arrogant beat.................	...	900	1,258	1,758	By the wind.
Arrogant beat.................	...	148	32	615	By the wind.
Arrogant beat.................	...	290	162	3,666	By the wind.
Encounter beat..............	4,480	1,037	259	...	Steaming and sailing before the wind.
Arrogant beat.................	...	1,980	440	845	Before the wind.
Arrogant beat.................	...	923	457	400	Before the wind.
Encounter beat..............	2,134	714	1,270	..	Steaming and sailing by the wind. During this trial the wind fell light, and the competition became only a steaming match.
Weight of a broadside in pounds, ...	984	796	644	312	

THE AMERICAN MUNICIPAL FIRE TELEGRAPH.—A chain of internal communication has just been completed throughout the various municipal stations or departments of Boston, U.S., by means of a modified form of the electric telegraph, so that the central station possesses the power of instantaneous communication with every other fire and police station in the city. The credit of this application belongs to Dr. Channing, who first brought forward its general principles in 1845, and finally presented an elaboration of his idea to the authorities of Boston in 1851. Under his superintendence, and with the assistance of Mr. Farmer as the constructive engineer, the plan has now been matured, and is in operation. The battery is on Grove's principle, and the wires are No. 8 of Swedish iron, carried along the buildings by wrought-iron brackets, fitted with Batchelder's ingenious insulators, consisting of a cast-iron cap lined with glass. There are about fifty miles of wires, the cost of which was under 100 dollars per mile; and this serves for the large number of sixty stations. The circuits of the fire system are divided into two kinds—"signal" and "alarm"—the one to convey intelligence to the central station, and the other, the action from the central station to the various alarm bells; and to add to the certainty of the connection, there are three several circuits for each kind. When a fire breaks out, the system is brought into operation at the nearest signal-box, or station, of which there are forty, about one hundred rods apart. These boxes are of cast-iron, fastened to the exterior of the buildings, and connected to the overhead line wires by insulated conductors enclosed in iron pipes. Each box has a signal-key for police communication, an electro-magnet included within the circuit, with an armature carrying a hammer for giving return-signals, a discharger of atmospheric electricity, and a signal crank for communicating the whereabouts of a fire to the central office. At this central station only a single operator is required. He has under his care three receiving-magnets, mounted together, and connected with the three signal circuits; a triple alarm and a Morse register, with three electro-magnets, levers, and pen points. The office alarm consists of three electro-magnets, each actuating a bell of a distinct tone. When a fire-signal arrives at the station, he goes to the district key-board used for transmission to the alarm bells, and gives the required signal according to the existing state of the fire. There are nineteen alarm bells in the three alarm circuits, each having a powerful striking machine, resembling a clock movement, for striking a single heavy blow at a time. Some of the bells are also rung for different purposes, therefore a self-acting shut-off is connected with the bell frame, to divert the battery current from the coils of the striking machine when the bell is in motion, and striking a small electro-magnetic call, to stop the sexton's ringing, should he be following this part of his vocation during the occurrence of a fire. When the alarm is to be given, the attendant holds down the key of his transmitting apparatus to give the fast alarm-ringing. Then all the nineteen bells strike two-second blows, and on the elevation of the finger this ceases, and the key, to point out the particular district where the fire is, is now pressed down, and strikes the specified signal, when the firemen at once know exactly where to go. The Boston apparatus cost 15,000 dollars, and it is calculated that the same system may be applied throughout the city of New York for 50,000 dollars.

OCEAN PENNY POSTAGE.—Reform in the long-endured evil of costly epistolary communication with places beyond sea, is at last taking a promising shape. It is no longer thought to be entirely beneath the consideration of the House of Commons, for not a few members are now concerning themselves about it. At the instance of Mr. Bright, a promise has been obtained from Mr. Disraeli, that it shall have a

place in the mass of matters to be thought about and arranged by the ministers during the existing recess. Nothing further has yet been said, but the promise implies that the Government really thinks there is something in the movement, and hence some step at least may be looked for. Is it not anomalous, that whilst we can send a pound of books to the Mauritius for a shilling, and printed papers under two ounces to America for a penny, we are yet compelled to pay a shilling for a half-ounce letter to the United States, and one shilling and tenpence to Madeira?

Department of Practical Art.—The authorities, upon lately re-opening their museum (after re-arrangement), have published a second edition of the catalogue of articles of ornamental art, collected together "for the use of students and manufacturers, and the consultation of the public." A comparison between this catalogue and that of last year, induces some curious observations. The title-page is different even to the very printer; and many of the poor unfortunate articles with hard foreign names, have been re-christened. One would have thought that, by this time, a few Indian, or other exotic names, had not been such terrible bugbears at the quill's end to a government institution. In the first edition, the first object noticed is a "purple sadee," in this, it is a "purple sarree;" the second object is first called a "purple kimkhwab," and now, a "purple kinkhob;" No. 15. "white silk shawl," in that, in this, "white silk sarree," &c. &c. Now, whether or not the last reading is the best or more correct, all this exhibits great carelessness, to say the least of it. We must not, however, be hypercritical, for there is much to make up for this, as any one desiring to profit most by the shortest visit will find. There is now some order introduced into the arrangement, and as much taste, probably, displayed in it as the thing has been capable of. A few hundred additional pounds have been profitably laid out, too, in the purchase of some more articles, which altogether are now classified, temporarily, as follows:—1. Woven; 2. Metal; 3. Ceramic or Pottery; 4. Glass; 5. Furniture; 6. Various. To each description of the particular article a concise "observation" is appended, leading the mind to the especial beauty for which the article has been selected. The museum itself is here and there decorated with full-length plaster figures of good design. There is a new department in the rooms for the exhibition of objects displaying *false principles* of design or ornamentation; and knowing how often (from some cause or another) we are more properly affected by opposition than by feeble encouragement, we are glad to see these things assembled together. The catalogue gives a few graphic illustrations of false figure, as well as some others showing beauty of outline. We think these illustrations might be greatly increased with proportionate advantage, as more powerful reminders to the student, on regaining his own room, after labouring in the museum. To the catalogue are appended various papers on the principles of practical art, showing what has been done for it in foreign schools, and from which very much useful information is to be obtained. We strongly recommend those of our readers who are interested in the subject, to purchase the small-priced catalogue for the sake of the appendix; for however hopeless it may be for many, from their distant residence, for a time, personally to inspect the contents of the museum, and derive the highest benefit it is capable of affording, much interest and instruction may be derived from this appendix. The museum is open every day, except Saturday; on Monday and Tuesday, free; the other days, sixpence is charged for admission.

Shuttleless Power-Loom for Weaving Narrow Fabrics.—Amongst the curiosities of weaving which the Exhibition last year brought prominently forward, was a curious contrivance for doing away with the shuttle in weaving narrow fabrics, fringes, and ribbons. The loom is the patented invention of Mr. W. Unsworth of Derby, formerly a partner in the firm of Messrs. T. S. Reed & Co. of that place, by which firm the machine was shown in the Exhibition. In the ordinary loom for weaving narrow fabrics, the play of the shuttle requires a space three or four times greater than that occupied by the web itself—an inconvenient loss of room, which all looms previously made were unable to escape. In the shuttleless loom, however, a mechanical action is introduced instead of the shuttle, so as to turn all the space to account. For example, the working loom in the Exhibition was filled with a fringe of 2½ inches wide, and held thirty-four breadths, whilst the common loom would only produce thirteen or fourteen breadths within the same limits. The weaving action is derived from a cam shaft running along the loom beneath the beam. This shaft actuates a line of short levers, or fingers—one at each width of fabric, and turning on horizontal hinges, or centres. Each finger terminates in a small eye, through which the shute, or weft, is passed, and as the shed is formed by the opening of the warp, the finger moves, and carries its thread across the piece. At the same instant, a needle rises and catches the loop of the returning thread, holding it tight until the finger returns, allowing the batten to advance for the beat-up. At this stage the reverse shed is formed, and the needle, which is flattened at its upper part, and sharpened to a knife edge, comes down and cuts the loop. This completes the fringe; and the motion being extremely rapid, the weaving movement is extremely interesting. Besides the economy of space thus secured, there are no pirns or quills to fill, and consequently no stoppage for supplying fresh material. The silk is wound upon large bobbins behind the harness, and is thence supplied in an unintermittent stream, so that the weaving goes on until the warp is finished.

English and French Patent Law.—The following remarks on an article in the *Union*, on these laws, are from Galignani:—By the former law in England there were separate patents for the three kingdoms, and the total cost which it was necessary to pay down was about £300, independently of the charge for specifications and the agents' charges, so that patents for England, Ireland, Scotland, and the colonies, cost nearly £400, and this sum had to be paid before the inventor could ascertain whether his patents were likely to produce him a farthing. By the new law there is only one patent for England, Ireland, Scotland, and the colonies, and the cost is very materially diminished, besides giving to the inventor the opportunity of paying his money in proportion as he sees that he has an interest in keeping up the patent. For £5 he can receive his patent right for six months; if in that time he has encouragement to proceed, he can secure the patent for three years by paying £20. At the end of three years he can extend the term to seven years by paying £50, and at the end of seven years he can secure a further term of seven years by paying £100. By the old French law a patent of 15 years cost £60 paid down, but by the present law this sum is divided into annuities of 100f. each, and as long as these annuities are paid up the patent is valid. The French law, therefore, is much more liberal to inventors than even the new in England, but the *Union* complains that it throws all the responsibility of the validity of the patent on the inventor, the Government guaranteeing nothing, and granting all that is asked for, without investigation, on the responsibility of the inventor; whereas in England a patent is not granted until its merits have been inquired by the authorities, thus avoiding, according to the *Union*, but not according to fact, a great deal of litigation. It is quite a mistake to suppose that the examination of a demand for a patent by the law authorities or by a committee appointed to investigate the claim, as is the case in most States of the Continent, is the slightest guarantee for the patentee. No Government guarantees the validity of a patent, and it is impossible to have more litigation as regards patents than takes place in England. Justice and common sense are entirely on the side of the present French principle. Every patent that is demanded is granted; it is for the inventor to be sure that his patent would be valid in a court of law, which fully guarantees him if his invention be new, and within the conditions on which patents are granted. Under the last French law on patents, a committee was charged to investigate the merits of the claims, and the patent was refused or granted on the report of that committee, and this is the case now in many of the States of the Continent. But what was the practical result of this system in France? It gave no additional security to a patentee, and it enabled committees, composed of persons, some of whom had a direct interest in refusing a patent, to check the progress of invention and industry. It was sufficient to tell an inventor that his discovery was not new, to deprive him and the public of its advantages, and favour some existing monopoly. At this moment there is in a neighbouring State a machine at work giving great profits to the inventor, and affording 50 per cent. saving to consumers. This patent was twice refused by the committee, and it was only after the exercise of great influenee and the personal intervention of the sovereign that it was granted. The *Union*, therefore, is quite in error on the importance that it attaches to preliminary investigation. The practical working of the patent law in France is, on the whole, good. It is liable, indeed, to abuses, and litigation cannot be avoided; but it opens no greater field for litigation than that in England, and the process here against piracy is more summary than that in England, and more protective of the rights of the patentee. There is one point, however, to which we would direct the serious attention of the French Government. The law declares that if the annuity of 100f. be paid a single hour after it has become due, the patent is forfeited, and the Ministry has no power to relieve the party who from illness, poverty, or negligence, has failed to pay the annuity. More than 50 patents are lost annually in France from the delay of a day or two in paying the annuity. In many cases the inventors forget the precise day on which it is due; in others, they are unable, from illness or absence, to make the payment in time. It is highly important that the Minister of the Interior should have the power of relieving the patentee when ready to pay the annuity, on his assigning a reasonable cause for the non-payment within the prescribed delay.

Penn's Trunk Marine Engines.—The excellent results obtained from Messrs. Penn's duplex trunk engines, as fitted to the *Arrogant*, *Agamemnon*, and other ships, have led to the supplying of the same class to the *St. Jean d'Acre*, 90 guns and 600 horse power. The diameter of the cylinders of the engines is 78 inches, the trunk 32¾, equal to 70¾ inches when the trunk is deducted; the length of stroke 3 feet 6 inches, the diameter of the engine shaft 13½ inches, and the screw shaft 12 inches. The diameter of the air-pump is 23½ inches, the diameter of the screw 18 feet, with a pitch of 20 feet 6 inches, the length being 3 feet 4 inches. The boilers are in 4 pieces, and the tubes 1904 in number, each 2½ inches diameter outside, and 6 feet 6 inches long. The fire-grates are 20 in number, and so arranged that the position for the stokers is well ventilated. There is also ample space for getting to every part of the engines, and the whole of the boilers and engines being considerably under the water line, they are well protected from injury in the event of the vessels in which they are fitted being engaged in actual warfare.

An Irish Ribandman's Fuse.—During the lately resuscitated discussion on Captain Warner's "long range," the Earl of Rosse mentioned a very curious circumstance in connection with explosive compounds. He remarked, in language with which we can feelingly sympathise, that scientific men were continually persecuted with projects of all sorts and kinds—perpetual motion, and machinery of the most extraordinary description. But of all the projects that had ever been brought before him in the way of explosions, the only one in which he thought there was any novelty, or a suggestion not known to the scientific world, was a project that was mentioned to him by an Irish ribandman. The circumstances were these—On various occasions, the banks of a canal had been destroyed. A great deal of mischief was done. Endeavours were made to discover the means by which it was effected; at last a party turned approver, and divulged the secret; he was a ribandman, and was sent to Lord Rosse, who supplied him with gunpowder; he prepared a mine, but there was no fuse; instead of a fuse, he made a mixture of quicklime, oatmeal, and nitric acid. Lord Rosse knew of nothing of the kind in any scientific work; however, the thing was tried, and the man said that in about four hours the mine would go off. It went off in four hours and a half, and an explosion took place. He asked the ribandman where he got his know-

ledge of the secret, and at last he succeeded in tracing it to France. He thought the man had made a more important communication than Mr. Warner, and mentioned it to the Government, but the only reward the man received was a free passage to America.

THE PALACE OF THE PEOPLE.—In our part for June last, we said a few words on the destination of the Crystal Palace; and while we are writing, the shell of the structure is being carried away, foot by foot, to contribute to the erection of a building which is to exceed in grandeur and simplicity the Great Crystal Dome, as that exceeded every preceding building for the same purpose. The company of proprietors, who have ventured upon the speculation in a truly English manner, commenced their labours, it may be said, on Thursday, the 5th of August, when, not the first stone, but the first pillar of the structure, was set up upon its foundation, and a grand dinner given. At this entertainment, a great number of the men of science and artists were received with all the honours; and it was likewise graced by the presence of many ladies and several noblemen, whose names it is always a pleasure to meet with. The opportunity, no doubt, was taken advantage of by the directors of the Crystal Palace Company, to initiate the general public into a few of the intended proceedings of the Company. Mr. Samuel Laing, the Chairman of the Brighton Railway and of the Crystal Palace Companies, officiated, first in planting the pillar, and then in the chair. The usual ceremonies, somewhat modified to suit the peculiar circumstances, were observed, and the pillar bears the following inscription :—

"This column, the first support of the Crystal Palace, a building of purely English architecture, destined for the recreation and instruction of the million, was erected on the 5th day of August, 1852, in the 16th year of the reign of her Majesty Queen Victoria, by Samuel Laing, Esq., M.P., chairman of the Crystal Palace Company. The original structure, of which this column forms a part, was built after the design of Sir Joseph Paxton, by Fox, Henderson, and Co., and stood in Hyde Park, where it received the contributions of all nations at the world's exhibition of the year of our Lord, 1851."

"—— I, your glass,
Will modestly discover to yourself,
That of yourself——,
Which yet you know not of."

In the speech which the Chairman made upon the occasion, he alluded to various details as to the interesting classes of machines and objects of all kinds, which it is intended should be handsomely housed within the building, as attractions for the people out of all common order; and we must say, that if these intentions are carried into execution, (and we know that English capital, all ready to do its work, *will* do its work,) such a mighty engine will be put in motion as will, at the same time as it enriches the speculators, afford such means for the moral improvement of the people of our country—high and low, rich and poor—as no country has ever yet possessed; while it will be to the shame of our land, if it do not abundantly profit by this the greatest palpable result of the Great Exhibition. The building, we are informed, will be in many respects similar to that in Hyde Park. Instead of one arched transept, there will be three, the centre, of course, being the largest and most elevated, and this will tower far above the highest trees in the park, so that it will be visible for many miles around. At either end of the building there will also be a square tower, which will give it somewhat of an ecclesiastical appearance. The internal decorations are to be intrusted to Mr. Owen Jones, who proposes to paint the low ranges of columns red, with capitals of yellow and blue intermingled with white, in proportion adjusted to the law of colour, the effect of which was so much admired in the old building. The pillars will support a gallery at a vast height from the floor, and from this gallery huge creeping plants of every kind will mount again to the arched roof, 150 feet above, and clustering round the iron framework, form trellis work, and festoons of pendant foliage and flowers; while giant palms, ferns, and plantains, every wonder and every curiosity of the vegetable world, will give character and variety to the collection. To the right and left, numerous avenues of rare trees, plants, and slender columns will extend, while three wider openings on each side will be produced by the intersections of the three great transepts. In front of every pair of columns will be a semicircular flower-bed, and from the centre of this will rise a statue on its pedestal. At each end of the nave an ornamental sheet of water will extend to some distance, uniformly ornamented with vases of elegant form, and having two bronze fountains to each, embellished with dolphins and other emblematical devices. An elegant bridge of light construction will afford the means of access to either side at these several portions of the great avenue. Like the rest of the building, these bridges will be constructed of iron, and, in conformity with the upper portion of the building, will be painted blue and white, with a complementary proportion of red on the under side of the ornamental rails. The large fountain in the centre of the great avenue will be of bronze, and of the most elaborate character. It will have power enough to throw up a jet of water to the height of 150 feet, and be flanked by colossal equestrian statues, with groups of statuary, and ornamented seats and vases. The avenues of trees will lead into beautiful courts in various styles of architecture, illustrative of the several styles of decoration of different ages and countries. There will be a Pompeian court, containing casts, paintings, and antique examples of objects found in this long-buried city. Mr. Wyatt will be intrusted with the design and arrangement of this quadrangle. There will also be an Egyptian court, containing varied examples of the ancient Pharaonic, the later Ptolemaic, and the still later Roman-Egyptian. M. Bonomi's intimate acquaintance with Egyptian antiquities and sculptures, at once point him out as the illustrator of this court. Among other casts will be one of the remarkable sitting colossi, which adorn the rock-hewn temple of Aboo Simbel, which, in the sitting posture, is upwards of forty-five feet high. Another quadrangle will be a restoration of one of the courts of the Alhambra, produced in all its brilliancy of gold and painting, in all its beauty of Moorish intricacy, and refined taste in ornament. Mediæval architecture will also be fittingly and profusely illustrated, from the ponderous Byzantine, through what we term in familiar language the Gothic in all its phases, to the elaborate but fantastic *renaissance;* and even recent Assyrian researches will be invoked to present us with a representation of the court and palace of Sennacherib. To all these attractions are to be added all the newest inventions in machinery and manufactures, exemplifications of the various processes used in different manufactures, a complete set of models of all the varieties of man, as large as life, and various other wonders. Irrespective of the internal attractions, the grounds are to be laid out with rich and rare plants, flowers, statuary, &c., so that nothing will be left undone to render the New Palace a worthy rival to its predecessor, and to attract within its walls not only the mere sightseer, but the student of nature and of art. We extract the following additional particulars, and which, with the above, will prove of great interest to our readers, from a weekly contemporary, through whose agreeable instrumentality the first Crystal Palace itself, no doubt, owed much of its fame; we need not mention "The Illustrated London News." "The site chosen for the re-erection of the New Crystal Palace is an irregular parallelogram of 300 acres, extending from the Brighton Railway, where it will have a frontage of 1,800 feet, between the Sydenham and the Anerley stations, to the road which borders the top of Dulwich wood, where it will have a frontage towards the road of 3,000 feet. The fall from this point to the Brighton Railway is 200 feet. It was at once felt that the only position for the new building was on the summit of this hill, and immediately adjoining the road. The building, placed in this commanding position, will be visible from London on the one side, and from a vast extent of country on the other. In consequence of the rapid fall of the ground, an additional story became necessary on the park front of the building; and this will remedy a defect universally felt in the old building, viz., the little elevation of the front. By the choice of this site, also, a complete change became necessary in the external character of the building. What in Hyde Park was the side, will here become the front. The great length of the old building prevented it being comprehended in one view; the new building will therefore be shorter by 240 feet. A transept, similar to the transept of the old building, will be placed at each end, and a centre transept, with a vast circular roof 120 feet in diameter, rising majestically over the circular roof of the nave. The transepts, with their aisles, will advance from the main line of the building, and thus form a most majestic group; at the intersections of the roofs of the transept and naves will be low towers, adding immensely to the general effect. A further improvement, of vast importance, is the introduction of arched recesses at the ends of these transepts, 24 feet deep; that of the centre transept, 194 feet high, and 120 feet wide; those of the side transepts, 150 feet high, and 72 feet wide. The improvements which will be made in the interior are not less important. Independent of the vast additional effect afforded by the increased height of the nave (44 feet higher than the old building), advantage has been taken of the necessities of the construction of this important feature to add greatly to the artistic effect of the interior. In the old building, the effect was secured by the simple repetition of two elements, a column and a girder; and although great grandeur was thus obtained, it may be said that there was hardly sufficient variety, and the full effect of the vastness of the structure was not entirely realized. At the extreme ends of the building, the columns and girders fell so rapidly one on the other, that the eye had no means of measuring the length; this defect had to be remedied in the new design, and it has been done in this wise—the columns and girders do not keep to one line as before, but every 72 feet, pairs of columns, 24 feet apart, advance eight feet into the nave, and from these columns spring arched girders eight feet deep, in lattice work of wrought iron, which support the longitudinal girders of the roof. These advancing columns are tied together, and thus form groups of pillars, like those of a Gothic cathedral. These groups occurring every 72 feet down the nave, thus furnish the eye the means of measuring the building, which it had not before. As regards the contents of the building, the whole of the sides of the nave, transepts, and the divisions on either side between the several courts, will be lined with the plants and trees of every clime, interspersed with statues and works of art. On the north-east side of the building will be arranged the historical galleries of sculpture and architecture, with casts of the finest works of sculpture, and portions of buildings of ancient art. On the south-east side will be displayed similar collections of mediæval art; while the north and south-west portions of the building, as well as the whole of a twenty-four feet gallery round the building, will be devoted to the purposes of exhibition. The machinery will be placed in the lower story, on the park side, in a gallery twenty-four feet wide, extending the whole length of the building. Outside, the decorations will have reference to the furnishing of the interior. The ends of the building will extend into large wings, projecting a considerable distance forward into the grounds, and encompassing terrace-gardens, which will themselves occupy more than thirty acres. Attached to one of these glass wings will be the railway station, so arranged, that persons descending from the railway carriages are at once introduced to the Palace by the wing. These wings will be terminated with grand glass towers, from which will be obtained extensive views of the gardens, fountains, and grounds, and also a view of the surrounding country to a very great distance. Beyond the terrace-gardens, which will be adorned with fountains and statuary, Sir Joseph Paxton has undertaken to carry out a design for waterworks, temples, and statuary, in forms and on a scale hitherto unknown. Two of the jets which he has in hand will rise to a height of 200 feet, and will form the main objects of interest from the glass towers already spoken of. Sir Joseph has also in preparation an unequalled collection of hardy and half-hardy plants, and an illustrative series, explanatory of the natural and Linnæan systems of botany. He has already secured for the Crystal Palace Company the magnificent collection of palms and other choice plants brought together during the past century by the Messrs. Lodridge, specimens hitherto unrivalled in Europe, and is daily adding to the number of his treasures by other specimens purchased from well-known collectors, or conferred upon him as gifts.

THE INDUSTRY OF SWITZERLAND.—The cotton manufacture in Switzerland employs 200 factories, with 800,000 spindles, 4,000 looms, and about 120,000 workmen, whose various earnings amount, in the whole, to more than 17,000,000 francs. Its working capital is 50,000,000 francs. The silk manufacture, with an equal amount of capital, employs 50,000 workmen, who serve 20,000 looms, and earn about 12,000,000 francs annually. Clockmaking, with plate and jewellery, furnishes employment to 40,000 hands, and brings them in a gain of 15,000,000 francs. Mining, with 5,000,000 francs of working capital, employs 10,000 men, whose salaries amount to 2,000,000 francs. The manufacture of tobacco gives work to 4,000 persons. The linen manufacture employs 1,000 workmen, who earn about 279,000 francs. In the manufacture of paper, 800 workmen gain 236,000 francs; and 64,000 persons, as well masters as workmen, gain 8,245,000 francs in the manufacture of straw-hats.

ENGLISH PATENTS.

Sealed from 18th September, to 18th October, 1852.

John Macintosh, New-street, Surrey, civil engineer,—"Improvements in manufacturing and refining sugar."—September 18th.

James Pillans Wilson, Belmont, Vauxhall, Surrey, gentleman,—"Improvements in the manufacture of cloths, and in the preparation of wool for the manufacture of woollen and other fabrics, and in the preparation of materials to be used for these purposes."—18th.

John Mitchell, Calenick, Cornwall.—"Improvements in purifying tin ores, and separating ores of tin from other minerals."—18th.

William Smith, Little Woolstowe, Bucks, farmer,—"Improvements in machinery for reaping."—18th.

George Hutchinson, Glasgow, merchant,—"A method of preparing oils for lubricating and burning."—18th.

James Warren, Montague Terrace, Mile-end Road, and Barnard Peard Walker, North-street, Wolverhampton,—"Improvements in the manufacture of screws and screw keys, and in the construction of bridges, applicable to floorings, roofings, and paving."—18th.

Moses Poole, London, gentleman,—"Improvements in combining caoutchouc with other matters."—18th.

Francois Mathieu, Hatton Garden, Middlesex, gentleman,—"Improvements in apparatus for containing, aërating, refrigerating, filtering, and drawing off liquids, and in ornamenting such apparatus."—23d.

John Lawson and Edward Lawson, Leeds, machine makers,—"Improvements in machinery for scutching and cleaning flax straw."—23d.

Jaques Leon Tardieu, Paris, gentleman,—"Certain improvements in the colouring of photographical images."—23d.

Robert Bowman Tennent, Gracechurch-street, London, merchant,—"Certain improvements in the mode of pulping cherry coffee, and in the machinery applicable thereto." 24th.

Henry Medhurst, Clerkenwell, Middlesex, engineer,—"Improvements in water-meters, and in regulating, indicating, and ascertaining the supply of water and liquids."—27th.

Auguste Edouard Laradoux Bellford, Castle-street, Holborn,—"Improvements in the manufacture of boots and shoes, part of which said improvements are also applicable to the manufacture of various other articles of dress."—(Communication.)—30th.

Moses Poole, London, gentleman,—"Improvements in the manufacture of combs."—(Communication.)—30th.

Sarah Lester, St. Peter's-square, Hammersmith, Middlesex, executrix of the late Michael Joseph John Donlan, Rugeley, Staffordshire, gentleman,—"Improvements in treating the seeds of flax and hemp, and also in the treatment of flax and hemp for dressing."—(Communication.)—30th.

Christopher Nickels, York-road, Lambeth, manufacturer, and Benjamin Burrows, Leicester,—"Improvements in weaving."—30th.

Henry Gardener Guion Jude, Lower Copenhagen-street, Barnsbury-road, Islington,—"Improvements in the manufacture of type."—(Communication.)—30th.

Charles Billson, Leicester, manufacturer, and Caleb Bedells, Leicester aforesaid, manufacturer,—"Improvements in the manufacture of articles of dress where looped fabrics are used, and in preparing looped fabrics for making articles of dress and parts of garments,"—30th.

Edouard Moride, Nantes, France,—"Certain improvements in tanning."—30th.

William Hunt, Stoke Prior, Worcester, manufacturing chemist,—"Certain improved modes or means of producing or obtaining ammoniacal salts."—30th.

Richard Archibald Brooman, of the firm of J. C. Robertson & Co., 166 Fleet-street, London, patent agents,—"Improvements in knitting machinery."—(Communication.)—October 7.

Richard Archibald Brooman, of the firm of J. C. Robertson & Co., 166 Fleet-street, London, patent agents,—"Improvements in the manufacture of sugar, and in the machinery and apparatus employed therein."—(Communication.)—7th.

Alexander Shairp, Patent Office, 166 Fleet-street, London,—"An improved cutting and slicing machine."—(Communication.)—7th.

John Reed Randell, Newlyn East, Cornwall, farmer,—"Improvements in cutting and reaping machines."—7th.

Pierre Armand Lecomte de Fontainemoreau, South-street, Finsbury,—"Certain improvements in washing, bleaching, and dyeing flax and hemp, and in mixing them with other textile substances."—(Communication.)—7th.

Solomon Andrews, Perth Amboy, United States, America, engineer,—"Improvements in machinery for cutting, punching, stamping, forging, and bending metals and other substances, which are also applicable to the driving of piles and other similar purposes, and to crushing and pulverising ores, and other hard substances."—7th.

William Edward Newton, Chancery-lane, Middlesex, civil engineer,—"Improvements in steam and other gauges."—(Communication.)—11th.

Richard Archibald Brooman, Fleet-street, London, patent-agent,—"Improvements in mowing, cutting, and reaping-machines."—(Communication.)—14th.

Walter Ricardo, of the firm of A. and W. Ricardo, London, share-broker,—"Improvements in gas-burners."—(Communication.)—14th.

Thomas Carter, Padstow, Cornwall, ship-builder,—"Improvements in propelling."—14th.

John Field, Warnford-court, Throgmorton-street,—"Improvements in transferring and printing."—14th.

SCOTCH PATENTS.

Sealed from 22d August, to 1st October, 1852.

Thomas Richardson, Newcastle-upon-Tyne,—"Improvements in the manufacture and preparation of magnesia and some of its salts."—26th August.

James Warren, Montague-terrace, Mile-end-road, gentleman,—"Improvements applicable to railways and railway carriages, and improvements in paving."—26th.

Alexander Parkes, Birmingham,—"Improvements in separating silver from other metals."—26th.

Frederick Sang, 58 Pall-mall, Middlesex, artist in fresco,—"Improvements in floating and moving vessels, vehicles, and other bodies in and over water."—26th.

Joseph Denton, Prestwich, Lancaster, gentleman,—"Certain improvements in machinery or apparatus for manufacturing looped, terry, or other similar fabrics."—26th.

Joseph William Schlesinger, Brixton, Surrey, gentleman,—"Improvements in fire-arms, in cartridges, and in the manufacture of powder."—26th.

Alexander Stewart, Glasgow, Lanark, North Britain, manufacturer,—"Improvements in the manufacture or production of ornamental fabrics."—27th.

Sir John Scott Lillie, Companion of the Honourable Order of the Bath, Pall-mall,—"Certain improvements in the construction or covering of walls, floors, roads, footpaths, and other surfaces."—31st.

Pierre Isodore David, Paris, France, machinist,—"Certain improvements in the method of bleaching, and in the apparatus connected therewith."—1st September.

Joshua Crockford, Southampton-place, Middlesex, gentleman,—"Improvements in brewing, and in brewing apparatus."—2d.

Thomas Wilks Lord, Leeds, York, flax and tow machine maker,—"Improvements in machinery for spinning, pressing, and heckling flax, tow, hemp, cotton, and other fibrous substances, and for the lubrication of the same, and other machinery."—2d.

Edmund Morewood, and George Rogers, Enfield, gentlemen,—"Improvements in the manufacture, shaping, and coating of metals, in applying that metal to building purposes, and the means of applying heat."—6th.

George Wright, Sheffield, also of Rotherham, York, artist,—"Improvements in stoves, grates, or fire-places."—11th.

Thomas Hunt, Leman-street, Goodman's-fields, Middlesex, gentleman,—"Improvements in fire-arms."—13th.

Alexander Mills Dix, Salford, Lancaster, brewer,—"Certain improvements in artificial illumination, and in the apparatus connected therewith, which improvements are also applicable to heating and other similar purposes."—16th.

John M'Conochie, Liverpool, Lancaster, engineer,—"Improvements in locomotive and other steam-engines and boilers, in railways, railway carriages and their appurtenances, also in machinery and apparatus for producing part or parts of such improvements."—20th.

IRISH PATENTS.

Sealed from 18th August, to 1st October, 1852.

Joshua Crockford, Southampton-place, Middlesex, gentleman,—"Improvements in brewing and in brewing apparatus."—7th Sept.

Henry Bessemer, Baxter-house, Old Saint-Pancras-road, Middlesex,—"Improvements in expressing saccharine fluids, and in the manufacture of refining and treating sugar."—11th.

DESIGNS FOR ARTICLES OF UTILITY.

Registered from 17th September, to 18th October, 1852.

Sept. 17th,	3371	E. D. Stones, Sheffield,—"Somacephalic bath."
—	3372	J. Carrington, Potton, Bedfordshire,—"Girth."
18th,	3373	J. W. Ingram and Co., Birmingham,—"Printing press."
—	3374	J. C. Meredith, Birmingham,—"Clog fastener."
23d,	3375	C. Dain, Southampton,—"Perpetual daily indicator."
24th,	3376	Samuel Whitfield and Jean Teychenné, Birmingham,—"Bedstead convertible into ottoman and sofa."
25th,	3377	W. D. Hornsby, Bartholomew-close, T. A. Burriage, St. John's-square, J. L. Barber, Cotton-mills, St. Martin's-lane, —"Netting pattern type."
Oct. 2d,	3378	Henry Stanbrough, Esq., Nutford-place, Edgeware-road,—"Invalid table."
12th,	3379	A. Lyon, 32 Windmill-street, City, and S. Middleton, Finsbury,—"Seamless lithographic roller."

DESIGNS FOR ARTICLES OF UTILITY.

Provisionally Registered from 16th September, to 18th October, 1852.

Sept. 16th,	467	Mrs. T. Groom, Walworth,—"Elastic waistband."
—	468	Mrs. T. Groom, Walworth,—"Elastic belt."
18th,	469	P. D. Nolet, Holborn,—"Travellers' copying-press."
20th,	470	J. Smith, Islington,—"Railway carriage wheel-lock."
—	471	A. Hely, Westminster,—"Hand-churn and egg-beater."
29th,	472	Pierre D. Nolet, Castle-street, Holborn,—"Copying-press."
Oct. 5th,	473	Joseph Lynn More Dorking, Surrey,—"Improved cricket stump."
7th,	474	John Hamilton, Brownlow-hill, Liverpool,—"Perforated sieve cradle."

TO READERS AND CORRESPONDENTS.

A SUBSCRIBER.—The particular machine which we have described has not yet been constructed, or we should, in all probability, have engraved it. We shall be glad to attend to his suggestion in some shape or other, when a really good working machine offers itself.

J. W., NOVA SCOTIA.—We have referred his inquiry to the proper quarter, whence he will obtain full information.

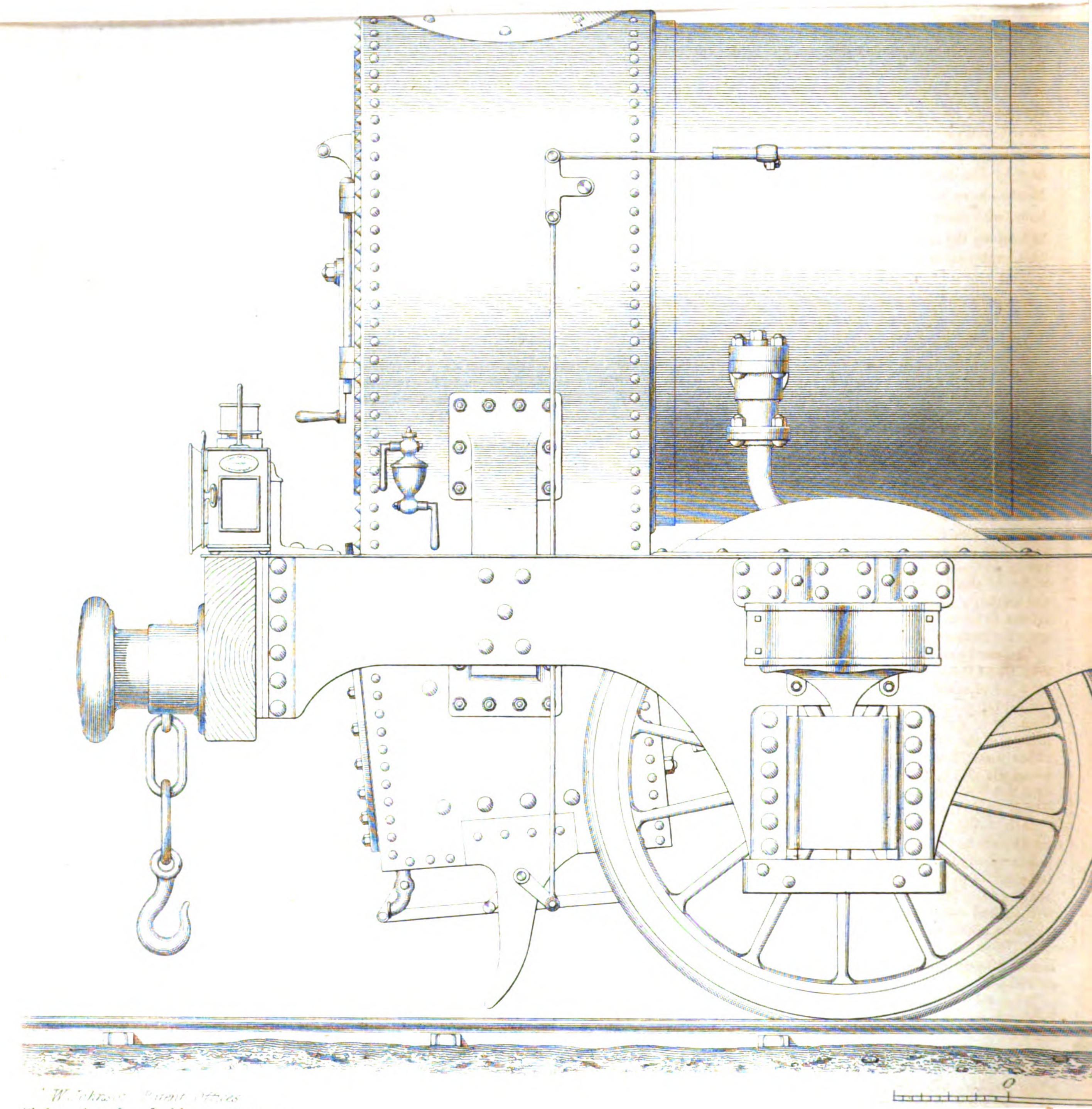
SUBSCRIBER, Isle-of-Man.—Various modifications have appeared in this *Journal*, as he will see by reference to the Index. If we meet with any improvements, we shall bear his request in mind.

W. J., Llanelly.—See pages 251 and 276, Vol. II., of this *Journal*. We are not aware of the existence of any machine actually at work.

RECEIVED.—"Lardner's Handbook of Natural Philosophy and Astronomy," (Second Course.)—"The Steam-Engine," &c. By P. Cameron.—"Strictures on the Conduct of the Police Committee, and the Inspector of the Smoke Nuisance," at Glasgow.—"Chart of Colours," 2d edition.—"Contributions to a Knowledge of the Phenomena of Zodiacal Light."—"On the Total Solar Eclipse of 1851." By Prof. C. P. Smyth.—"Home Resorts for Invalids." By S. E. Haskins, Esq., F.R.S.—"The Meteor of the 12th of August, 1852." By James Glaisher, Esq., F.R.S.—"Wachter's Safety Rail and Stopping Apparatus."—"Mouatis' Hydraulic Syphon."—"The Mechanic," Nos. 1, 2, 3, 5, 6, 7, 8, 9, and 10.

ENGINEER, Winsford.—It is owing to the peculiar oxydizing effect of atmospheric air when brought into intimate and forcible contact with the particles of cream. See page 4, Vol. III., *P. M. Journal*. The great success of the American churn was owing entirely to the intermingling of air by means of the cavities in the beaters. There are many varieties of atmospheric churns. We regret we cannot answer the latter portion of his request, except by referring him to the Encyclopædias.

J. NORTON, Cork.—Received, but too late for insertion this month.



M'CONNELL'S EXPRESS LOCOMOTIVE ON THE LONDON AND NORTH-WESTERN RAILWAY.

(*Illustrated by Plate* 112.)

The directors of the London and North-Western Railway lately announced their determination to run express passenger trains between London and Birmingham, a distance of 112 miles, in two hours; and the question of the accomplishment of this high rate of regular travelling, has therefore occasioned much anxious consideration amongst the engineering authorities of the line. There were many requirements to be kept in view. Great and long-sustained power and speed, and steady running, without excessive weight, must all enter into the arrangement of the locomotives from which so much is expected. Mr. M'Connell has therefore expended more than ordinary care in designing engines which should be capable of performances hitherto quite unparalleled in the history of "the new art of transport." Our plate 112 presents an external elevation of this new class of engine, ten of which have been ordered for completion before the end of the year. Of these, two—one by Messrs. Fairbairn, the other by Messrs. E. B. Wilson & Co. of Leeds—have been already built and tried, at a rate of sixty miles per hour, with unequivocal success; and the rest will shortly be set to work, to keep up the intended systematic two hours' communications. As the best explanation of the peculiarities of the engine, we here furnish the official

SPECIFICATION OF MATERIALS, CONSTRUCTION, AND DIMENSIONS OF THE PASSENGER ENGINES.

1st.—The *Engines* to be ten in number.

2nd.—They are to be made with inside cylinders, outside and inside frames, and six wheels; the driving-wheel being seven feet six inches diameter, and arranged in the manner hereinafter described.

3rd.—The *Cylinders* to be eighteen inches diameter, and the length of stroke two feet, fitted up with pistons made of wrought-iron or steel, to be made by Mr. Goodfellow of Manchester. The cylinders to be of the hardest and best iron, and to be free from all defects; to be bored perfectly parallel, and true when fitted. The cylinder faces to be made accurately to the drawing; also, the ports and passages and the faces to be scraped to a perfect surface for the valves.

4th.—The *Boilers* to be eleven feet nine inches long in the cylinder, and four feet three and a quarter inches external diameter, and to be made perfectly circular and straight. The plates, angle-iron, and rivets, to be of the best Lowmoor or Bowling iron, or of equal quality, with the maker's name stamped in a legible manner on each plate. The rivets to be three-fourths of an inch diameter; and to be one and three quarter inches apart, from centre to centre of rivet. The plates for the cylindrical part of boiler to be three-eighths of an inch in thickness; and those for the outer shell of fire-box to be of Lowmoor or Bowling iron, or of equal quality, three-eighths of an inch in thickness; and the tube-plates of the smoke-box end also to be of Lowmoor or Bowling iron, or of equal quality; to be three-fourths of an inch thick. The plates of the smoke-boxes and smoke-box door to be of the best Staffordshire iron, five-sixteenths of an inch in thickness. The chimneys to be made also of Staffordshire iron, one quarter of an inch in thickness; and the whole of the parts of the boilers and smoke-boxes to be made and fitted up in the manner shown in the drawings, which will be supplied.

5th.—The *Fire-boxes* to be made as shown in drawing, and introduced as shown in the cylinder part of the boiler, four feet nine inches; to be made of the best copper plate, free from all defects when worked. The tube-plate to be three-fourths of an inch in thickness, where the tubes are fixed. The sides and end plates to be three-eighths of an inch thick, and the roof-plates to be seven-sixteenths of an inch thick. The bottom plates to be one-half inch thick. The boxes to be made with a middle partition in them; the plates of these partitions to be of copper, made three-eighths of an inch in thickness, and formed as shown in drawing.

The following are the leading inside dimensions of the fire-box:—Length on fire-bar to be five feet ten inches and one quarter. The length at roof to be ten feet six inches. Depth above fire-bars at front plate, six feet five inches. Depth at door-plate, six feet ten inches. Width on fire-bar, four feet. Length in cylinder of boiler, four feet nine inches. Height at narrowest part, two feet three inches. Height at tube-plate, three feet. Width at tube-plate, three feet nine inches.

The top of the box to be supported by twenty-five wrought-iron bearers, twenty of which to be five inches deep by one inch thick, and the five nearest tube-plate five inches deep, by one and a half inches thick. These bearers to rest at their ends on the side plates of the fire-box; and to be screwed to the top plate by bolts one inch diameter, placed four and a half inches from centre to centre, screwed into the top plate. The screw to be of fine thread, next head of bolt, to be one inch and an eighth diameter; the head of the bolt to be inside the fire-box, and a nut on the end of the bolts on the top of the bearers, with one inch screw.

The *Fire-box* to be stayed to the boiler by copper bolts, seven-eighths of an inch diameter, screwed into the plates with a fine-threaded screw, having both ends riveted carefully, and placed four inches apart, from centre to centre. This also applies to the mid partition.

The end plates above the fire-box to be stayed to the smoke-box tube plate, by connecting them together by two stay bolts, each one inch and a quarter diameter.

6th.—The *Tubes* to be of brass, and made of the very best quality, by the manufacturer who supplies the Company at present; or of other equal quality, and to the approval of the Company's engineer. There will be three hundred and three tubes in each engine; the size, one and three quarter inches outside diameter, to section furnished; and the thickness of metal to be No. twelve wire-guage at fire-box end, and No. fourteen wire-guage at smoke-box end.

7th.—The *Wheels* are to be made entirely of the best scrap wrought-iron, and of the very best workmanship. The driving-wheel, without the tyre, to be seven feet one and a half inches diameter. The tyres to be of the best Lowmoor, Bowling, or of equal quality; to be finished five and a quarter inches wide, and two and a quarter inches thick on the tread. The sizes of the wheel in all its parts will be furnished by the Company's locomotive engineer at Wolverton.

8th.—The *Crank Axles* to be made of the very best iron from the Lowmoor, Bowling, or the Haigh foundry forges, or of other equal quality, complete and perfect to the sizes given when finished. A full-size drawing of the crank-axle in its parts will be supplied. The outside bearings to be seven inches diameter, and ten inches in length. The inside bearings seven inches diameter, and four and a quarter inches in length. The crank bearings to be seven inches diameter, and four inches in length.

9th.—The *Straight Axles* to be tubular, as shown in the drawing, of best quality of iron, seven and a quarter inches external diameter, and one and a half inches thick of metal. The bearings of the leading and trailing axles to be the same size as the crank; viz., seven inches diameter by ten inches long.

10th.—The *Axle Boxes* and brass bearings to be made according to the drawing which will be supplied.

11th.—The *Springs*, links, and attachments to the axle-boxes, to be supplied by the Company, and applied according to the instructions of their engineer at Wolverton.

12th.—The *Pumps* to be made of tough brass to the drawing furnished. The clacks and boxes to be accurately finished and fitted. The pump-rams to be made of strong tough brass, with wrought-iron cross-heads, as per drawing.

13th.—The *Steam Pipes*, blast and feed pipes, to be made of the best copper, three-sixteenths of an inch thick, with copper flanges, as per drawings to be supplied.

14th.—*Regulator* to be made of brass, on the equilibrium principle, as per drawing.

15th.—The *Eccentric Straps* to be made of the best wrought-iron, lined with gun metal of the best quality, according to drawing, accurately fitted, and to have all the oil syphons forged on.

16th.—The *Slide Valves* to be made of gun metal, and to have an outside lap of one and a quarter inch. They are to have an oil or grease cup attached on each side of the smoke-box, to lubricate them.

17th.—The *Connecting-rods* to be made of the very best quality of wrought-iron, fitted accurately. The straps to be made as per drawing, and the oil syphons to be forged on them.

18th.—The *Expansion Gear* to be made as per drawing, all the working and wearing joints and surfaces to be steeled and hardened, or case hardened. The distance from the centres of the leading wheel axle to the centres of the middle axle, to be exactly eight feet four inches, and from the centre of the middle to the centre of the trailing axle, eight feet six inches.

19th.—These *Engines* are to be manufactured of the very best materials and workmanship throughout, and supplied in every respect with water-guages, steam-taps for heating water in tender, whistle, blow-off cocks, cylinder-cocks, pet-cocks, reversing and expansion gear worked from the foot-plate; screw draw-bars (proper and in duplicate), ash-pan, damper, sand-boxes, a full set of tools, lamp-irons, &c.

Detail drawings of all the parts will be supplied by the Company's engineer at Wolverton, previous to manufacture.

20th.—The *Safety Valves* to be two in number, and to have Salter's balance applied; each valve to be three and a half inches diameter, and the levers to be of such length, that one pound upon the end of the lever shall indicate exactly one pound upon each square inch of the valve.

The range of the spring-balance to be graduated up to one hundred and fifty pounds.

All the steam joints to be fitted together by scraping, so as to be iron to iron when the joint is made; and the bolts to be placed not more than three inches apart from centre to centre of bolt.

21st.—The *Cylinder* and *Valve-chest Covers* to be of wrought-iron, to drawings furnished.

The *Fire-frame* to be made in two parts, with a drop apparatus, to drawings.

These engines to have brass domes over the steam-pipe and safety-valve, of the best yellow sheet brass; finished and fitted in the best manner, to drawings to be supplied.

The engines and tenders to have four distinct coats of the best paint, to be finished to a specimen colour furnished by the Company's engineer. Between each coat of paint, to be rubbed down with ground pumice-stone to a level smooth surface, and all imperfections removed: to be lined and finished as required, and to receive four distinct coats of the best carriage varnish, and properly hardened between each coat.

All the axles, bolts, pins, screws, and parts of machinery of these engines, to be made exactly to guages, determined by Mr. M'Connell, so that they may be perfect duplicates of each other throughout; and the Company's engineer at Wolverton, or his assistant, shall at all times, when they think proper, visit the work while in progress, to see that the materials and construction are quite according to specification and drawing. Any alteration in the minor details of this specification to be adopted, if considered advisable by Mr. M'Connell.

TENDERS.

The *Frames* are to be entirely of wrought-iron, the framing to be made of the form and dimensions as shown in the drawing; the plates being of the best Staffordshire iron, fitted up in the best manner. The side tank plates to be also of Staffordshire iron, three-sixteenths of an inch thick, with strong angle-irons as shown, and framed with flat plates outside; the floor and top plates throughout are to be one quarter of an inch thick.

The *Wheels* to be three feet nine inches diameter, to be six in number, and to be made entirely of wrought-iron, of the very best quality and workmanship. The tyres of the wheels to be of the best Lowmoor, Bowling, or patent shaft iron, or of equal quality, to be approved by the Company's engineer, finished to two inches and a quarter thick on the tread.

Drawings of the wheels, with axles and axle-boxes, in detail, will be supplied.

The *Axles* to be tubular as per drawing, of quality of iron approved by the Company's engineer.

The *Springs*, as in the case of the engines, to be supplied by the Company, and applied according to the engineer's instructions.

The apparatus of the *Break* will be according to drawing, and a break is to be applied to each wheel.

The *Tenders* are to be capable of containing two thousand gallons of water, and two tons of coke, and to have spring-buffers on each end; to be supplied by the Company, and fixed according to the instructions of their engineer.

The *Draw-rod* of the tender will go through from one buffer-spring to the other. The floor of tender and footplate of engine to be exactly a level when properly loaded and road-worthy; with a joint flap-plate fixed to the tender, to overlay between the engine and tender.

The above particulars, with the accompanying drawings, are considered sufficient to enable the manufacturers to make their estimates. If any further information be required, the Company's locomotive engineer, at Wolverton, will afford it on application.

The engines and tenders are to be subjected to the examination and approval of the Company's locomotive engineer; and are to be delivered when completed, free of charge, upon the London and North-Western Line of Railway.

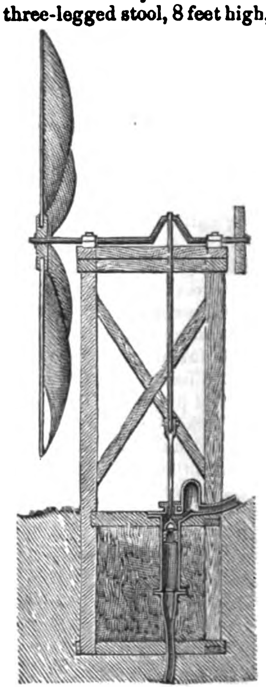
Our readers will thus see that the new locomotive embodies a great variety of novelties. The extension of the fire-box into the barrel of the boiler in conjunction with short tubes; tubular fire-box stays for the air supply; the lowering of the centre of gravity by recessing the under side of the boiler; dished wrought-iron pistons;* and Mr. Coleman's india-rubber buffers and bearing springs; are all modifications of existing practice, which will now be thoroughly tested. The superiority of the plan of trusting to direct radiant heat rather than to carried heat, or currents on the tube surface, has been already manifested; for forty-five minutes now suffices to raise steam of 100 lbs. in the boiler, where formerly three hours were required. We shall defer our further notes until we present the remaining plates of the series, with which we propose to illustrate this latest triumph of engineering science.

* See *P. M. Journal*, page 102, for August last.

ON RAISING WATER FOR THE PURPOSE OF IRRIGATION IN THE COLONIES.†

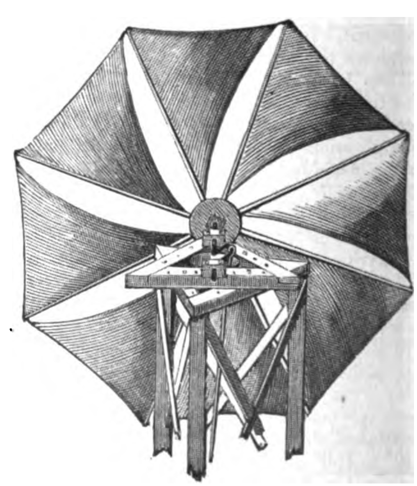
By Professor C. Piazzi Smyth.

First, as to the stand: the usual conical tower of masonry was not to be thought of; but, in place of it, was made a three-legged stool, 8 feet high, strengthened with diagonal braces, and having cross bars below, on which the pump barrel was screwed, having its axis vertical, and coinciding with that of the stool. This was then firmly fixed, by having its foot buried in the ground to the depth of 3 feet; and though such a position might seem likely to induce a rotting of the timber, that did not supervene in this case, although the wood was merely deal—on account, perhaps, of Kyan's anti-dry-rot solution having been employed.



Sectional View of the Apparatus.

Next, as to the moving parts—the windmill, in fact—with which, in general, so many wheels, and axes, and cog-teeth are connected. These were, however, got rid of in this instance, by making the horizontal axis of the sail-wheel of round bar-iron, 1¼ inch thick, and by bending it into a crank in the middle of its length, where it passed over the axis of the stool. A connecting-rod being then extended between this crank and the piston-rod of the pump, the rotatory motion of the sails was at once converted into the reciprocating motion of the pump. The wind was too regular in its direction in that country to make any automatic method of keeping the sails always turned towards the wind desirable. But to have some means of occasionally changing the direction of the axle by hand, its bearings were not fixed at once to the top of the stool, but to an intermediary triangle, that revolved upon that, by means of an intermediary iron ring, and could be fastened down firmly in any position, by inserting screw-bolts through corresponding holes in the two wooden frames. Finding, however, after three years' experience, that the direction of the axle had only been changed as many times, the moveable triangle was fastened down permanently in one position;—not that the wind had only altered its direction three times in all that interval, but that it altered always by 180°, being generally either south or north;



Back View of the Windmill, showing the Means of Adjustment towards any Point of the Compass.

† Concluded from page 178, *ante.*

and from the construction of the sails and stand, they acted almost equally well, whether the wind came on their face or their back.

But the stand, it will be observed, was only 5 feet high above ground; this, therefore, limited the length of sail-arm that could be employed, and made it more than ever necessary to obtain the greatest possible motive power within the smallest radial compass.

Now, Smeaton has laid down from his experiments, in the most lucid and admirable manner, the qualities which the sails of windmills should have; and strange it is, that his suggestions have not been more completely followed out.

His rules are, that sails are more powerful—1st, the more nearly they fill up the circle which they describe in revolving, always leaving a small space for the wind to escape between the sails; 2d, the broader that they are at the extremities; 3d, the more numerous they are, still presenting the same surface; and 4th, when the surface is slightly concave towards the wind. Now, these requirements are evidently but ill fulfilled by ordinary windmill sails, which are so long and narrow, and so few in number, as to fill but a small part of the circle which they describe during a revolution, or to realize the other good effects; and, further, the making of the sail-arms, and preparation of the wooden lattice-work whereon to spread the canvas, was objectionable on the score of expense, and on that also of injury done to the wood, which was to be exposed to such a splitting and searching effect of torrid sunshine.

I therefore gladly availed myself of the advice of my friend, the late John Skirrow, C.E., and made the sails in the shape of the foresails of a boat, nailing one side along one of the arms, and extending the opposite angle by a "sheet" rope to the end of the next arm. The sails thus made, eight in number, were not only more simple than on the old plan, but carried out exactly all Smeaton's recommendations—for they nearly filled the whole circle of revolution; they were broadest at their outward extremities, and they were numerous, and were concave towards the wind. While further, by a simple alteration of the length of the sheet rope, each sail fell back from the plane of the wheel at the proper angle, to give the greatest propelling force in the rotatory direction; and each part of the sail, reckoning from the centre of the circle outwards, inclined at the true angle for that part, the quantity of inclination gradually decreasing towards the circumference.

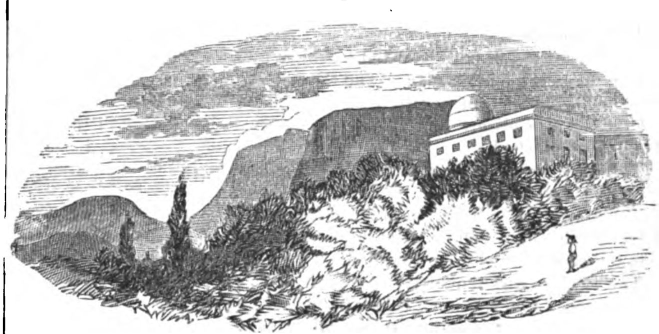
This method, moreover, gave a very simple plan of regulation for the varying strength of the wind; for, by making the sheet rope elastic, the sail would fall back farther and farther from the plane of revolution, and not only present a less surface to the wind, but be impelled to move at a less rate in proportion to that of the wind. And on one occasion, by way of trial, the wheel went round slower in a storm of wind, with all eight sails set, but with long slack sheet ropes, than in the same wind with only one sail set, and that close hauled; for evidently, according to the angle, and the proportionate lengths of the base and perpendicular of the triangle—of which the sail is the hypothenuse, the wind the perpendicular, and the sail's motion the base—the sail may be made to move, resistance not being too great, at either a less or a higher rate of speed than that of the wind, to any extent.

A small brake-wheel being then added at the other end of the horizontal axis, with counterpoise for the weight of the sail-arms—and these being loaded, on one side, with half the weight required to pull up the piston-rod, and so equalize the resistance through a whole revolution—completed the windmill pump.

Then began its pumping operations, and they were continued ever after during my residence at the Cape, pumping up to the top of the hill a continuous stream of about 400 gallons an hour, in a strong wind, through summer and winter, with little or no attention being required for the machinery.

Meanwhile, the scanty soil on the top of the hill had been sown with seeds of the Pinus pinea, and Pinus pinata, as being hardy trees, and because seeds tend to produce varieties, of which those adapted to the peculiarities of the situation live, while the others die. When a man will transplant, his nursery for raising trees should be in as bad a soil, and inclement a situation, as that wherein they are intended finally to stand; but in so hot and dry a climate as that of South Africa, it will be found better to sow the seeds at once in their places, for no transplanted specimen in open ground can stand the fierceness of the solar rays; they search and find out all the gardener's trickery—no specious appearance can resist their discriminating power. And when it is mentioned that the surface ground sometimes acquires a temperature of 140° to 150° on a summer's day, it is plain the mere "ball of earth" conveyed with the tree, will be quite exhausted of all its moisture, before the unfortunate plant has been able to establish relations with the soil of its new neighbourhood.*

The seedling firs, however, sown thickly, and growing all together, rose slowly, but surely, against the sweeping wind, which cut their tops as level as a bowling-green. When they had reached some little height, a space was cleared in the midst of them, and here was introduced the fountain-head of the windmill pump, sometimes spouting the water up in a jet through a conical tube, to produce artificial rain, at other times



Effects of the Irrigation after Seven Years, from a Calotype.

giving rise to little glittering streams, flowing along the surface of the ground. Into this were then inserted all the more tender and *recherché* trees of a warm climate—orange, lemon, figs, vines, guava, cypress, myrtle, roses, and my funny friend's "oaks," of course. Indeed, so completely was the character of the hill altered from its dried and windy condition formerly, to its sheltered and watered state now, that bananas, of all trees requiring most water and shelter, grew, and produced fruit before I left. "How is it possible?" said one Boer. "But then you have water now," said another. "Very well; and could it not have been introduced at any time before? was it not perfectly possible, when you said that it was impossible? and is it not quite possible even now, with immense extents of land at present lying waste and unproductive, because the water is running into the sea at a lower level?"

Mode of Supplying the Water, and its Effects.

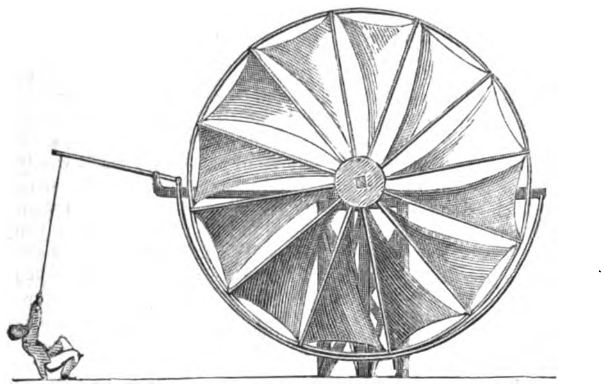
The example was followed by many persons; but from this actual instance being on so small a scale—it was useless to *say* that it might be carried out on a far larger one, or to talk of the gigantic Cornish pumping engines—nothing that was not visible could be believed; and no person, amongst the farmers of my acquaintance at the Cape, having seen a pump of greater diameter than 4 inches, they would not believe that a greater could be made; certainly, they persisted, none large enough

* I have entered into these particulars, because I am convinced that if the same plan were followed here, the lamentable bareness of so many of our Scottish hills might easily be improved. When I stood, last summer, in Caithness, where not a tree was to be seen, though, it was said, that a few miles off was *the* tree which, the year before, had so alarmed the horse which the venturesome tourists had driven that far from his accustomed haunts and sights, as actually to be brought within range of the unwonted spectacle, and to be so frightened thereat, as to overturn gig and travellers, and injure himself;—when standing there, and inquiring the reason of such a state of things, I was told that trees had been tried, but the wind was too powerful for them. But in every case of which I could learn the particulars, they were transplanted, not sown trees; and though the wind might be abundant, it was certainly not equal in strength and constancy to the Cape winds. The Highland wind might be deficient in genial warmth, but it was much better supplied with the invigorating moisture, while the soil of the hills about Thurso was far deeper and better adapted for the vigorous growth of large trees, than the whinstone hill of the Cape Observatory. If, therefore, the larches and firs were *sown* over those bare hills, and kept free from weeds for two or three years, until they were able to choke the weeds, instead of the weeds choking them, there would seem to be no reason why the North and the East of the country should not be again fertile in wood, as it is reported to have been in former times.

to enable them to water their fields. I had arranged to have erected a larger one, but the measure was interfered with by my leaving the colony; and I can only now recommend something of the sort to the practical men in this country.

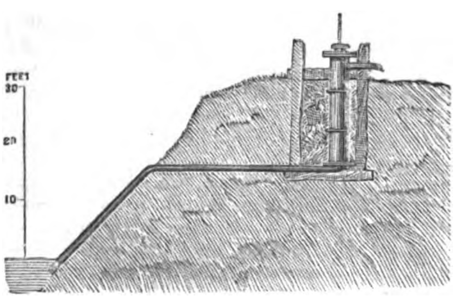
The iron-work of the pump and mill might be made here, and put together out in the colony; and there can be no doubt that, when once arrived, it would be eagerly purchased up. Men would know exactly what it would cost them, and they would have it at once in useful work. But they have a great horror, and naturally, in sending home an order to unknown persons, at an unknown cost, and having to work an indefinite length of time before they see anything for their money.

The only alteration which I would suggest on the mill described, is to convert the small brake-wheel into a second wind sail-wheel; it will be an easy mode of balancing the other, and will be found to give much additional power. And as weight in the wheels is useful in equalizing the force of gusts of wind, the sail arms should be left full and square, as sawn, up to the ends; and then connected together with tangential arcs, forming a rude and large wheel, on the circumference of which the brake may act with great effect.



Improved Form of Sail-wheel of Brake.

A sucking pump should also be used whenever it is possible, and the bucket, by means of a long piston rod, should be thrust down as low as possible. Some caution should be used as to the sort of packing, valves, &c.: metal ones would doubtless be the safest; and where the water is full of sharp sand and stones, a solid plunger, working in a stuffing-box at the top, as in the Cornish engines, should be adopted, in place of a piston and cylinder. But where leather can be properly attended to, I am bound to say that I have met with no pump offering so little friction and resistance as Shalder's "fountain pump," where the vacuum is preserved by a diaphragm of leather, rolling upon itself. I have not had, however, any experience in it for long-continued use, but its maker has attestations of its wearing well, and passing sand and gravel with facility. Messrs. Garret of Leeds have arranged a very effective and portable form of the brass plunger pump, with exhausting and pressure air-vessels combined in one casting; and Messrs. Ransome and May have contrived an equally portable triple pump for three horses, which would be very useful during periods of calm weather. If they were further to arrange for the manufacture of the iron-work for the application of the power of wind on the above principles, and publish full price lists, there is little doubt but they would greatly benefit themselves, and the southern colonies also.



Arrangement of Pump adapted for the Bank of a River.

As some guide to the size of the machine to produce specific effects, I may say that a radial length of 12 feet of sail-arm, in the average strength of the trade wind, might be expected to raise 3000 gallons an hour to a height of 30 feet—and this, making a considerable allowance for friction and defective mechanism; and therefore equal to about the productive work of an average colonial horse. For other radial dimensions, the power will vary as the square of the radius.

Before concluding, it may be as well to guard against mistake, by specially disclaiming all idea of there being anything novel, or anything difficult, in the application of wind to working pumps for the purpose of irrigation. But it is a very useful operation; and I trust that the *manner* in which it has been done in this instance has something, as a whole, that is new, besides being remarkably simple, and more effective, and certainly better adapted to the colonies than any that I have seen or heard of. Indeed, it is in this point of view that I wish the notice to be regarded; and without presuming to say that the greatest possible degree of simplicity and effect has been reached, it will yet, perhaps, be generally allowed, that an account of actual practice in any new locality, and especially successful practice, is worth putting upon record.

THE PLEASURES OF SCIENCE.

No. II.

The examples of facts which we have lately given, as operating to induce high gratification to the observer, have been selected almost at random, and serve to show the general character, in this respect, of all facts which tend to the elucidation of principle. It were a very easy task to select particular ones from particular departments, which are equally exemplary; but the real difficulty is in placing them, so concisely and at the same time so fully in their bearings, before the general reader, as to enable him adequately to appreciate their significant potency. Hence it is that writers on this subject have plunged into the trite and common-place, instead of the grand and the elevating. The true path is always difficult, attended often with great labour of research, and requires a more than ordinary discrimination, which, however willing to act upon, is not often accorded to him who would participate with others the pleasures he has himself experienced. The real delighter in scientific pursuits needs no stimulus of extraneous pleasure; but, go where he will, observe what he may, speak with whom he likes, thousands of singular things present themselves, attended rarely but with the most happy associations. The air, the field, and the flood, man and man's bearing, each affords him times of peaceful exercise of thought—never, in the citizen, ending in a solitary quiescence, but acting as the prime mover to advance. Now here is a fact which is among those not sufficiently known, but which only requires to be known to be appreciated. There was, some years since, an old tree standing in the botanical gardens at Rouen, in Normandy. Many interesting traditions were connected with it, which the directors, no doubt, considered would be pushed out of memory were the old tree to perish. It was fast disintegrating at the surface of the soil, and the curators' attention was urgently requested towards its preservation. It seemed to be a hopeless case, and the great tree of the forest appeared sensibly to be undergoing the same doom as the short-lived grass of the field. Fortunately, the curator was a man of science. He had already made many observations respecting the dissemination of the sap generally in the vegetable world; and, reasoning from the result of numerous experiments he had also made, he, at the proper season, planted around the stump (for it was little more, and the leaves had begun to die away at the top) some cuttings of the same wood. When these had well taken root, he cut off the tops, and grafted them on to the stump. Things remained thus for three or four years, and as the lateral leaves and shoots displayed themselves, he carefully and very gradually cut them off, until eventually he was gratified in observing, as his scientific knowledge led him to anticipate, that the new sap was beginning to perform its office, and cause new shoots at the top of the old tree. In another three or four years he completed the experiment by absolutely cutting away the entire lower portion of the trunk of the tree, leaving the upper part thus resting on the cuttings (by this time of a good size) which had been grafted on; and the last we heard of it from the gentleman himself who performed this experiment was, that it was flourishing with new and healthy life, and long likely to continue a living monument of his knowledge, skill, and ingenuity. The Academy of Sciences at Paris awarded M. Crace Calvert the large medal for what he had thus done.

The divisibility of matter affords many facts so striking to the imagination, as to yield considerable pleasure in first becoming acquainted with them. Thus, a piece of wire, gilt with so small a quantity as eight grains of gold, may without difficulty be drawn out to a length of 13,000 feet (nearly two miles and a half), the whole surface of it still remaining covered with gold. So, again, a quantity of vitriol being dissolved and mixed with 9000 times as much water, will tinge the whole; while light (which is, perhaps, one of the least ponderable forms of matter), in the mere rays of a candle exposed on a plain, will discover its presence

in a space about twelve miles in circumference; or, if the candle were placed two miles above the surface of the earth, it would fill with luminous particles a sphere four miles in diameter.

But it is not so much in things which object themselves to the ordinary sense of mankind that science offers the meed of pleasure to its cultivators, as in those matters brought within the fields of the microscope and telescope. If we roam among the worlds of atoms, mighty and pleasurable thoughts are aroused by the facts which they disclose. The microscope (which science has all but perfected) shows life in animalculæ, a million of which together would barely occupy the space of a small grain of sand. And if we reflect upon the capacity of enjoyment pervading other departments of nature more exposed to general observation, we cannot but infer that every minute point of creation contains a world of beings, partaking in due measure of its allotted portion of happiness, by playing their several parts, minute but important, in the general scheme. The mind of individual man—standing, as it were, on a point of time between two eternities—is thus enabled to contrast itself with the infinitely minute, and, by means of the vast regions presented by the telescope, to stretch itself out to the infinitely vast, until, in the midst of the survey of the magnificence of the physical heavens and earth, it is lost in wonder and delight. Who can give adequate expression to that feeling with which the attention becomes suffused when observing, with but a slightly scientific eye, the planets and the stars as they appear on a bright night, forming a light-spangled awning over our resting hemisphere? Who does not recall with pleasure the impressions which were first made upon him by the greetings of his imagination (cordially accepted as real) which arose from the suggestions of the astronomer? When we heard him first tell his story of our sun and its family of worlds, haply of several generations, he commanded us to conceive that the more distant stars (which are now in the book of science losing their ancient name of *fixed* stars) are also suns similar in constitution to our own, surrounded by, and giving light, life, and enjoyment to many other orbs rolling on, like our own, but at as yet an immeasurable distance from us, in a course of harmony and order, and that the whole, comprising

—— "Numbers, without number, numberless,"

which the brightest imagination may attempt to grasp, may be but as a point, without comparative parts or magnitude in the immensity of creation. And who dares step between happiness and its author, and say, this little globe which we inhabit is (among the thousands upon thousands of its companions) the only receptacle of physical, mental, and moral life—of enjoyment and of hope?

But upon what are these vast speculations founded? We hear and read of the inconceivable distances of the "heavenly bodies" one from another. We are told that the moon is about 24,000 miles from the earth—the earth 95,000,000 of miles from the sun—and the grand new planet more than 3,200,000,000 of miles from that luminary; while the star which is supposed to be one of the nearest to us, has been estimated to be at a distance of no less than a hundred millions of millions of miles. The question how these extraordinary facts have been ascertained has doubtless occurred to every reflecting mind; but the result itself appears to many so out of the reach of ordinary power, that some have supposed them impossible, while they have consented to receive the statements as harmless fictions. They are no fictions; but, with the aid which science has furnished, are capable of proof as demonstrative as that two and two make four, or as any truth can be. Faith or confidence in these results has been greatly confirmed by the circumstances attending the discovery of the planet Neptune. Simple as they are, see what a wonderful result was obtained by carefully observing them. As all particles of matter attract one another, every one of our planets must, in some relative degree, attract all the others. In their revolutions in their orbits round the sun, when they approach nearer to one another, the attraction is necessarily greater than when they are at a distance. This produces irregularities in their motions, which have all been calculated and referred to the important law of gravitation. It so happened, however, that some such irregularity of motion in the planet Uranus (for long considered to be the outermost in our system) could not be explained by any such attraction by the sun or any of the known planets. Now that it has been pointed out to us, we can all *now* readily see how easy it was to *suppose* a body, as yet invisible, situate beyond the orbit of Uranus, exercising a similar influence on it, and we *now* also readily see how easy it must have been to those who could make the one calculation to make the other. But the inversion of the calculations necessary was a mode not thought of by any before Adams of Cambridge and Leverrier of Paris, singularly enough, prosecuted, silently and simultaneously, the course of mathematical reasoning devised by them, and which was unparalleled in the history of astronomy. It is well remembered how these keen-sighted mathematicians bade the gazing telescopic observer of the skies point his tube to the spot where a body must be producing the irregularities we have noticed, and there, sure enough, the dimly luminous disc of the before-unknown planet was seen! It may be supposed that such a result of mathematical investigation was not arrived at without great thought, without great industry. M. Leverrier's calculations, which have been published, occupy upwards of 940 printed pages; and the intense abstraction required may be conceived, when but one false logical sequent from line to line, or from figure to figure, would completely have vitiated the final result! That individual is not to be envied who experiences no gratification when, for the first time, he hears or reads the statement of such a fact as this.

Such are some among the multitude of pleasures attending the prosecution of science—pleasures resulting, probably, from the simple acquisition of the increased powers which form the constituent of all new facts. And who may arrogate to himself (among all the workers of the world) the greatest merit in introducing such new facts to our acquaintance? We answer authoritatively—the mechanic. Barely glance at the means towards discovery which *he* has created in the telescope and microscope! Look at the hosts of instruments of all kinds which *his* ingenuity has called into being, as but other varieties of glasses, whereby the concealed in nature may become disclosed, and ready to be manipulated into forms for the advantage and comfort of mankind. Who but the thoughtful mechanic has intersected all lands with the wondrous rail and the more wondrous "wire," and sends forth its new ploughs over all oceans, and, by various machines, aids in in-barning in our homes the abundant harvest of the world? We say the *thoughtful* mechanic; for it is such alone we can regard as the moving power of life. The incentives to such thoughtfulness lie around in all directions; and let our young friends especially take heed that they strive to catch the inspiration which they afford, while, as they know, *there are yet things to be done.*

The mere companionship with the sublime thoughts induced by all scientific truth, is in itself, to the appreciating consciousness, a high incentive to devote the greater portion of leisure to inquire into the secondary causes of the visible and invisible creations. The hope of the possibility of merely personal advantage becomes thus necessarily absorbed in the brighter and more enduring hope of benefiting their race.

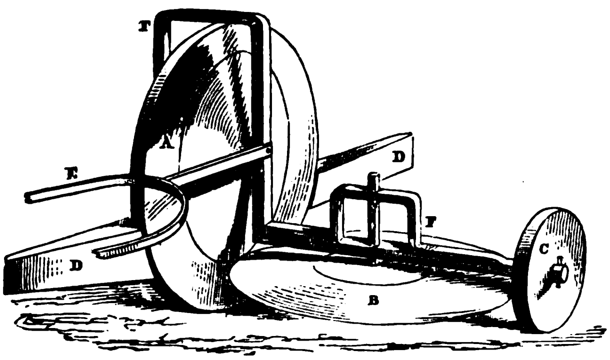
In the papers we have lately written on science and its pleasures, we have endeavoured to give some idea of its nature, of its objects or aims, and of a few of the benefits and pleasures attendant on its prosecution—interesting to all, but justly most so to those for whom our pages are designed. The subject is obviously an inexhaustible one, pervading as it does every object of observation. Did it occupy more fully both public and private attention, we should seldom hear of eloquence in the unconsciousness of ignorance, misleading a national council, and rarely of the disasters of war. But the national mind would be educated—led forth into proper and wholesome exercise—and, what is more, taught to educate itself, which is really to know itself. Each individual passing through his noviciate of gradually decreasing error, would become an advancing priest of knowledge, and the stream of good which the magic wand of his will would cause to flow from the rock of ignorance, would flow on and on, before his very eyes, to the most distant posterity. It is on you, our young friends who read these lines, that many are looking for absolute deliverance from many evils. Beware how you exercise your mighty power, and which, for the good or ill of yourselves, your country, and the world, has been intrusted to your keeping. *Nulla dies sine lineâ*, said the painter; and what he said is equally applicable to you. Let no day pass over your heads without learning something which you did not before know, or imparting something which you did. All science looks to you still for many new teachings.

CONTRIBUTIONS TO THE MECHANISM OF REAPING.

I cannot claim any special practical knowledge of reaping, yet I venture to forward to the *Practical Mechanic's Journal* three several reaping contrivances, which offer, I think, some advantages in point of simplicity, lightness, and absence of friction. In the first of the series, fig. 1, A is a large running wheel, in the form of a disc, with its inner side very flatly conoidal; and B is a horizontal steel-edged wheel or plate, set upon a short vertical spindle in the framing of the machine, which is carried on the offside by a small supporting wheel, C. The disc, B, is knife-edged, and this cutting edge revolves close up to the face of the wheel, A, the corn being cut between these two surfaces when directed in by the contractor, D. This contractor is a longitudinal bar, recessed on one side to receive and embrace the wheel, A, and sloped at each end, on the same side as the recess, in the direction of the cone of the wheel. Hence, as the machine is drawn forward over the harvest field, the contractor bends

in the corn towards the wheel, A, so that the straw becomes jammed between the wheel and the disc cutter. This causes the cutter to revolve, and the corn being thereby cut, there being no room for it to pass without being severed. The machine is worked by a horse attached

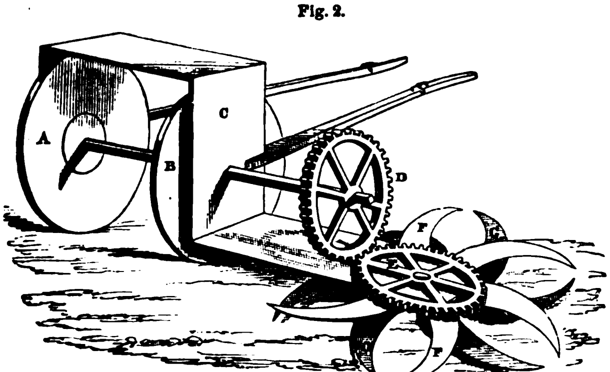
Fig. 1.



to the shaft, E, the simple frame, F, being all that is necessary for carrying the entire mechanism. The machine and wheel, C, work *outside* the corn, and can be so driven as to take in more or less grain, as may be desired.

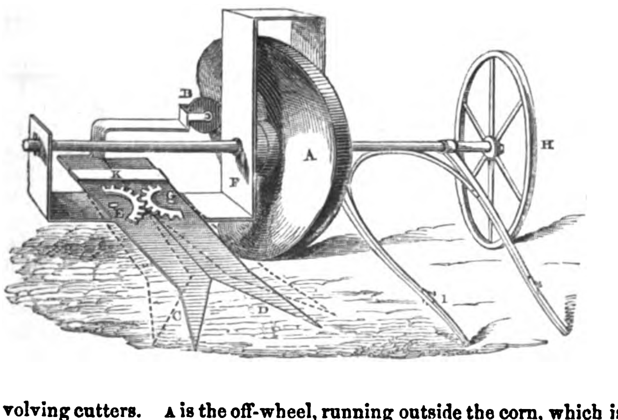
In a previous arrangement, the cutter, B, merely acted against a bar, instead of the wheel, A; but the present mode seems the best, as by the other one the corn was only drawn in by its contact with the cutter, B, and therefore might be torn down instead of being cut; but in the present plan the cutting is facilitated by the duplex action of the wheels, A and B.

Fig. 2.



In fig. 2 the machine runs on the pair of parallel wheels, A B, fast on a horizontal axle, the projecting end of which carries a toothed wheel, D, in gear with a counterpart wheel, E, the shaft of which carries a series of scythe-shaped cutters, F. These cutters revolve with the shaft, and immediately beneath them is a second set, G, of similar shape, but stationary, and set with their cutting edges in opposition to those of the re-

Fig. 3.



volving cutters. A is the off-wheel, running outside the corn, which is cut by being pressed between the two sets of cutters. Instead of the fixed set of cutters, a second reversed rotating series might be substituted; but this would add to the complexity of the machine.

In the third arrangement, the cutting action is accomplished by means of a pair of shears. A is the actuating wheel, driven by its contact with the ground. This wheel is differentially curved, and a pulley, B, bears against one of its faces—this pulley being carried in the end of an arm fast to one of a pair of oscillating shears, C D. These shears oscillate on distinct centres, E G, in the framing, F, and they are geared together to work simultaneously, by the segmental toothed wheels on their upper sides. The shafts, I, form the tractive apparatus, and H is the off-wheel. Then, as the machine travels along, the action of the wheel, A, on the pulley, B, closes the pair of cutting blades, the opening for the succeeding cut being effected by the india-rubber band, K, which keeps the pulley, B, constantly pressed against the differentially curved surface of the wheel. The projecting ends of the blades are to be beveled outwards, so as always to retain some straw in their grasp, otherwise they would leave much uncut.

I have herein made no provision for laying the grain when cut; but as all the three schemes cut sidewise, instead of running directly into the corn, such contrivance may probably be dispensed with. If not, a shelving covering might be so applied as to pass off the corn to its proper place. LEWIS GOMPERTZ.

London, November, 1852.

WRIGHT & HYATT'S ELLIPTIC ROTATORY ENGINE.

(*Illustrated by Plate* 113.)

The "elliptic rotatory engine" is one of the most successful examples of the modern attempts to apply steam power directly to a revolving crank lever, so as to economise steam, lessen the weight, simplify the constructive details, and convey the power directly to its work. Such an engine is, indeed, practically equivalent to the causing the steam to lay hold of and actuate the crank or revolving shaft, just as the hand turns round a winch, without the intervention of joints, levers, and connecting-rods. It is the invention of Mr. William Hyatt, the engineer to Champion's extensive Vinegar Works, of Old Street Road, St. Luke's, London, and is being carried out by him, in conjunction with Mr. Wright, the managing proprietor of the works. The essential peculiarity of the engine is to be found in the fact, that the steam cylinder is bored elliptically, in order that the revolving piston within it, when set upon a shaft disposed eccentrically in relation to the minor axis of the ellipse, may fit accurately to the elliptic surface throughout the entire revolution. This is a peculiar and unlooked-for characteristic of the elliptical figure. The true action is only to be secured when the amount of ellipticity is exceedingly slight, the centre of motion of the revolving piston-shaft being in a line intersecting the minor axis, at about one-third the length of such axis. That such an engine does work in the most satisfactory manner, is now practically exemplified at the Old Street Vinegar Works, where the engine, from which our drawings in plate 113 were made, is in daily operation.

Fig. 1 on that plate is an external longitudinal elevation of the engine in working order. Fig. 2 is a corresponding end elevation, at right angles to fig. 1, the front end cover of the cylinder being removed to show the piston within. Fig. 3 is a plan of the engine.

The short steam cylinder, A, open at each end, and fitted with two end covers, is placed with its axis horizontal upon the base plate, B, being bolted down thereon by four projecting eyes, C. The horizontal piston-rod, or main engine-shaft, D, is passed eccentrically through the cylinder, and in the vertical line of the minor or conjugate axis of the ellipse. The cast-iron rotatory piston, E, is suitably fitted with packing-pieces, and slotted transversely at F, to fit to the piston-rod, the transverse section of which at that part is rectangular. The slot, F, is for the purpose of allowing of the self-adjustment of the piston during its revolution in working, by sliding laterally over the squared shaft or rod, D; or, instead of this more direct sliding action, a frame may be introduced to carry antifriction rollers, working upon the shaft surface, and adjustable by the aid of screws and wedges. The packing of the piston—which packing is, at the same time, a portion of the working steam-pressure surface—consists of two metallic strips or ribs, G, of the length of the cylinder, the outer projecting surface of such ribs being rounded, whilst their inner flat sides are fitted into shallow grooves, H, formed diametrically opposite to each other along the piston, and in its axial line. The actual working packings are strips of metal, I, fitted on their inner sides to the external rounded surfaces of the pieces, G, whilst their outer surfaces bear against the interior of the cylinder. These outer rubbing surfaces of the packings, I, are considerably rounded in transverse section, the radius of curvature being slightly less than that of the quickest curve of the cylinder's bore, so

Fig. 1.

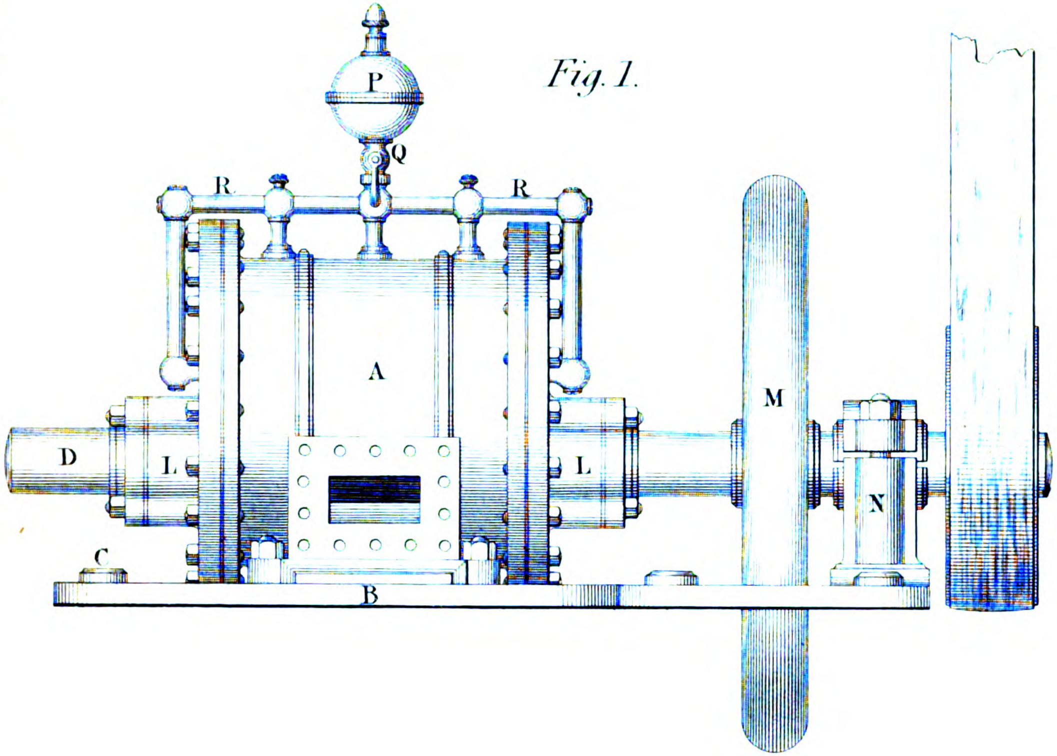


Fig. 2.

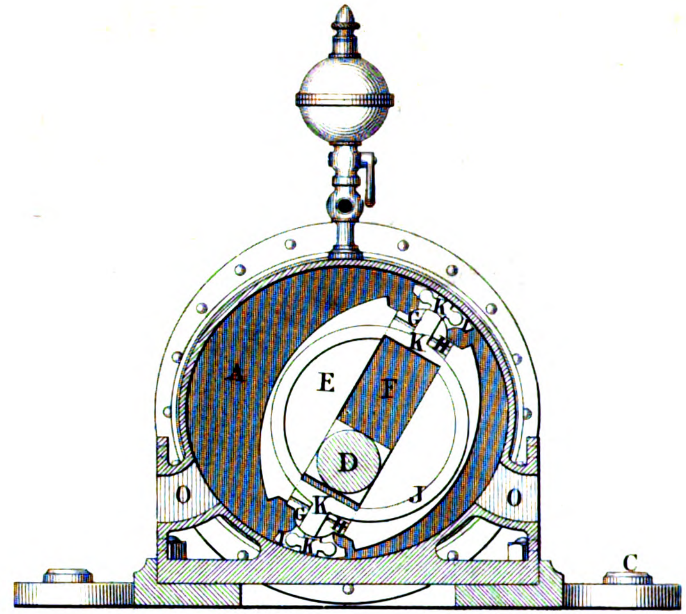
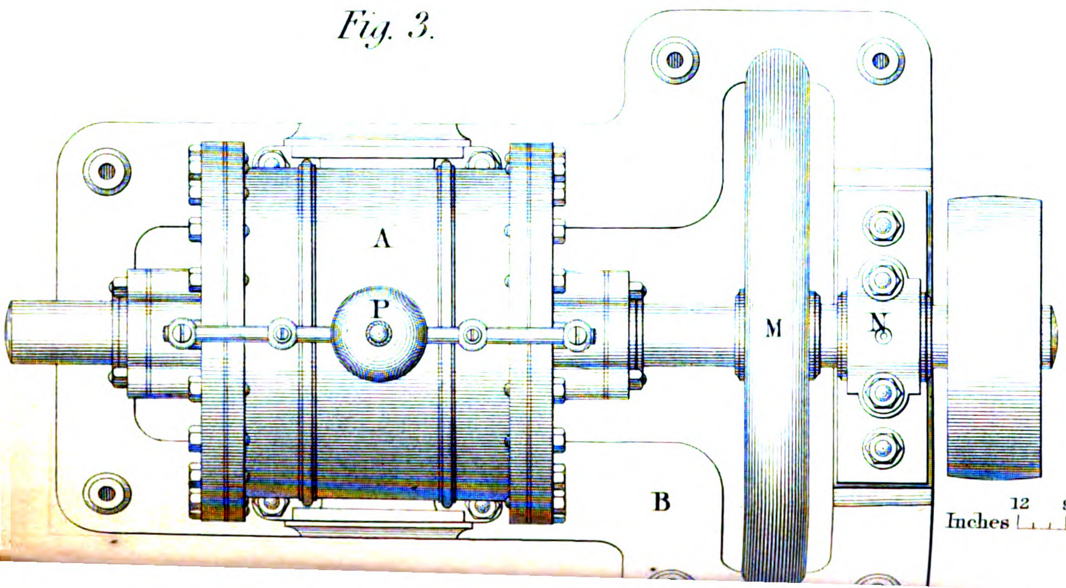


Fig. 3.



ELLIPTIC CYLINDER

ROTATORY ENGINE.

MESSRS. WRIGHT & HYATT.

LONDON.

SCALE

that the packing may work round the sharpest elliptic curves with facility, and helical springs are set in behind the packing-pieces to admit of a free adjustment during working. The flat end packing for keeping the piston steam-tight at its two ends, is composed, in each case, of the brass ring, J, let into the end of the piston, and having two projections, K, upon it, passing through slots in the end of the strips, G, thus forming a simple and effective end packing. A small brass plate, K', is let into the end of the strips, I, to complete the end packing. The piston-rod is supported in a stuffing-box, L, on the outside of each cylinder end cover, and the engine in the present case being a single one, the shaft has a fly-wheel, M, keyed upon it, the heavy rim of the wheel being cast hollow at certain parts to balance the overhang of the piston. That end of the shaft which passes away to the machinery to be driven is supported in a pedestal, N, bolted down on the base plate; this bearing, in conjunction with the pair of stuffing-boxes, being the only bearings requisite. When one end only of the shaft is used for driving, no working valves are required in this engine, the steam being admitted in a constant stream by either of the two opposite ports, O, the only variation of the current being when the slot, F, is horizontal, this being the dead centre of the engine, and both ports are then closed. Or, by another slight modification, the steam and exhaust ports may be made to extend a long way round the cylinder, in order that the engine may have no dead point, the steam being admitted to the back of the revolving piston-blade before it is entirely shut off from the front side. For reversing, an ordinary three-way cock answers every purpose, one cock being set on each side of the cylinder, and put in connection by means of two double-branched pipes, so that either side may be made the steam ingress side. The steam acts equally well in both directions of revolution, the effective pressure being that upon the overhang, or eccentricity of the piston, which is constantly varying in effective area throughout the revolution, the piston being indeed a direct-acting crank-lever for turning the shaft. For lubrication, an oil-reservoir, P, is set on the top of the cylinder, a stop-cock, Q, being fitted beneath it, to command the flow through the pipes, R, which have each two branches for lubricating the bared portion of the cylinder and the flat end cover surfaces. The length of the axial line of the cylinder of the engine in our plate is 24 inches, whilst its diameter or bore is to be defined by an ellipse with a major axis of $20\frac{1}{8}$ inches, and a minor axis of $18\frac{5}{8}$ inches. This engine is called a 30-horse, whilst with a pressure of 32 lbs. of steam, the indicator has shown a power of 50 horses. Our readers may judge of its compactness by comparing this power with the area actually occupied, as shown in our drawing.

We think we may safely point to Mr. Hyatt's engine as being the simplest and most compact of the really effective existing examples of the direct-pressure rotatory class. It is evidently applicable for all the purposes to which the ordinary engine can be applied, as well as to many which are beyond the reach of the old form. With an actuating power applied to its shaft, it at once becomes a forcing or exhausting pump; and, slightly modified, it becomes suitable for the purposes of locomotion. As a railway engine, it is proposed to use two cylinders—one on each driving axle—the axles being thus made the engine piston-rods, whilst the dead points are of course avoided by the usual expedient of setting the lines of greatest effect at right angles to each other, the axles being coupled in the common way.

But the most obvious application of the engine is for screw propulsion. The screw-shaft becomes the piston-rod, and as there is no reciprocation about it, any reasonable speed is attainable, whilst the power is conveyed direct to the screw. Indeed, the practical value of this motor is, in our opinion, as great as its peculiar mechanical action is elegant.

ON THE GENERATION OF COLD BY THE EXPANSION OF ATMOSPHERIC AIR ARTIFICIALLY COMPRESSED.*

By John Gorrie, M.D.

It requires a nice experiment to determine the quantity of heat disengaged by the condensation of atmospheric air, and a truly delicate one to place beyond dispute the numerical quantity absorbed by its expansion. Of the difficulties which have attended an accurate solution of these questions, we may see proofs in the published results of experiments, made by such eminent men as Dalton and Gay-Lussac. These philosophers, in an examination of the more simple problem of the heat set free by condensation, differed so widely in their estimate of quantity, that while the former, as before mentioned, considered the reduction of air from its atmospheric to a double tension, produced only 50° F., the latter estimated that its condensation to one-fifth of its volume, evolved heat enough to ignite tinder, or, as he states, to produce about 580° F. Reduced to a common tension, and compared with a law of the relation of caloric to air at different densities, that I have established and shall presently explain, the latter experiment will be found to give considerably upwards of 300° F., as the quantity of heat disengaged by the condensation of air from its ordinary tension to that of two atmospheres. When results so discordant and perplexing are obtained from experiments easily made, it is not surprising that philosophers of high eminence should so confound effects, flowing from the reciprocal and entangled action and reaction of an elastic fluid, rushing with violence into another elastic fluid, as to mistake a simple effect of evaporation for that of the dilatation of air.

Experiments on this subject were made by me several years ago, and a description of the method pursued, as well as a detailed account of the results, so far as they related to the heat evolved by condensation, were published in the *American Journal of Science*, vol. x. pp. 39—49, and 214—227. Deductions relating to the quantity of heat absorbed by the expansion of air were equally complete, but they were complicated with calculations of allowances for losses from radient heat, which subsequent investigations have shown me may be superseded; and, besides, there occurred at the time circumstances of a moral character, over which I had no control, tending to impair my confidence in their accuracy, and I forbore to impart them to the public. Considering the accuracy of a discovery of more importance than even its magnitude, I have recently tested my former experiments with others on whose approximate correctness I can fully rely. I have not yet had time for classifying and arranging these experiments, and making the deductions which are necessary to enable them to be easily understood; but I am engaged in doing so, and when finished they will be published in a form intelligible, and in a place accessible to practical men. I will at present remark, that they assure me my former experiments were in the main correct; and though subsequent investigations may prove that none of my labours have produced perfectly accurate results, yet, when the peculiar and delicate nature of the elements dealt with are considered, I feel there is no demerit in having attained merely an approach to truth. When distinguished philosophers, in connection with this subject, have exposed science to ridicule, by pretending to assign and explain a law that has no existence, a slight numerical error is of comparatively little importance.

There is another point of view in which the relation of atmospheric air to caloric is, I believe, universally misunderstood. The mathematical law which connects the evolution and absorption of heat with the compression and expansion of atmospheric air, does not conform to regular increments or decrements of density. An error has arisen, in this respect, from that spirit of generalization which leads philosophers to apply the law of inverse squares, in attempts to explain all kinds of molecular and radiating actions. Instead of an increase or diminution of the density of atmospheric air affording an equal multiple or submultiple of the heat evolved or absorbed, we find, by experiment, that the law is one of rapidly accelerating progression, direct or inverse. Thus, according to my experiments, the compression of air from its ordinary condition to half its volume, or to a tension of two atmospheres, evolves 280° F. of heat; another equal diminution, or to a tension of four atmospheres, will not disengage another 280° F. (as assumed by most theorists, and adduced by Professor Smyth from the theory of Mr. Petrie, vol. iii. p. 195), but only about 140° F.; and a reduction of this volume to one-half, or to a density of eight atmospheres, will only disengage from it about 70° F. more. If, therefore, the densities of air be placed in the geometrical progression, 2, 4, 8, the corresponding temperatures will be, as nearly as at present ascertained, in the inverse proportion, 8, 4, 2; and the converse of the positions will be equally true for expansions of air. I consider, from the numerous experiments I have made with nearly the same results, that the law may be regarded as at least approximatively established for the above small range of densities; but perhaps it ought not to be looked upon as ascertained for all changes of volume of the same quantity of air.

An accurate determination, and a thorough knowledge of this law, are indispensable to the most economical application of expanding air to the production of artificial cold. The law involves, also, other considerations, equally novel and interesting, which I shall make some attempt to explain. Numerous investigations of the relation of heat to the vapour of water, show that no such law applies to that fluid, and whether it is held in common by any other vapour or gas, requires experiments to determine. But as the discovery of a new fact in science is commonly the mere forerunner of the discovery of a general law, or, at least, indicates its existence, it is probable that all gases vary from each other in the quantity of heat they evolve under the same decrements of volume from pressure, and in their affinity for heat under similar degrees of expansion. In this variable relation of gases to heat, it is probable we

* Concluded from page 173, *ante*.

shall find the law by which they are more or less reducible to the liquid condition. It is easy to see, independent of experiment, that there is in the existing laws of organic creation a natural want, which renders such a relation as I have described, between air and heat, more likely to exist, than that equal multiples or divisions of bulk of a given quantity of the former should produce equal increments or decrements of temperature. Like the expansion of water as it approaches the freezing point, it appears at present to be one of those exceptions to general laws of nature, which are no sooner discovered than they are found to be instituted for wise and salutary purposes. If the numerical quantities of temperature set free, corresponded with the reductions of volume, it would require very little calculation to demonstrate, that whatever may be the quantity of heat in union with air, we could speedily divest it of such a portion as must reduce it to a liquid, or, like carbonic acid, convert it into one of the solids of the earth. But according to the formula I have adduced, though infinite compression of air must develop infinite quantities of heat, yet the resultant quantities, as the densities increase, diminish so rapidly, and become soon so exceedingly small, that if we suppose its latent heat no greater than that of steam, it would be almost impossible to represent, in figures, the degree of compression that would disengage the whole of it. It is, therefore, highly probable that nature, having in view its indispensable importance as a fluid for the preservation of all the living world, has endued it with properties absolutely forbidding its change from that condition. This view is strengthened by the consideration, that notwithstanding the well-known experiments and belief of the late Mr. Perkins, art has never been able to change atmospheric air into a solid or a liquid; while it is, at least, doubtful whether it is ever altered by nature from its necessary condition of an elastic fluid, though numerous evidences are afforded of each of its principal elements—oxygen and nitrogen—being both liquefied and solidified.

The suggestion, that artificial cold may be produced by the expansion of atmospheric air, is by no means founded on a late discovery in natural philosophy; nor is the idea of applying it practically, so far at least as its attendant evaporation produces refrigeration, due to any particular individual. It is reasonable to suppose, that among the numerous attempts made in every age to apply the fountain of Hero to useful purposes, it must have been frequently observed, that the compression of air evolved heat; and the observation would naturally suggest—what, indeed, the accompanying evaporation would actually demonstrate—that its escape must produce cold. Some form of this instrument, and its capability of producing ice, were no doubt known to the Marquis of Worcester; for, in the eighteenth proposition of his 'Century of Inventions,' he speaks of "an artificial fountain holding a great quantity of water, and having sufficient force, under the management of a child, to make snow, ice, and thunder." Several years ago a patent was taken out in this country, for a modification of the Chemnitz fountain, or rather for a very close counterpart of Professor Smyth's figured instrument, which was to be applied to the manufacture of ice; and numerous similar propositions have from time to time appeared in various countries. The perseverance in these attempts affords another illustration to the many in existence, of how long it is possible to hover over the brink of a valuable truth without perceiving it, while it indicates a great want of a process for producing ice economically, and a dissatisfaction with those contrivances for the purpose at present before the world.

The principle upon which Professor Smyth's machine is constructed, being a discovery of antiquity, it is unnecessary to contend with you about the claim you make for him over me, of priority of application; but I deem it proper to take some notice of it as a part of the history of the subject. Professor Smyth says (*P. M. Journal*, vol. iii. p. 156):—"When this idea first occured to me in 1843, I could procure no data which would enable me to calculate its practicability within any moderate limits." Considering that he also undertakes (page 155) to "give an account of what others have done in the same direction before him," I must be allowed to call this a careless assertion, because it shows that he could have made very little research into the subject. At the time he refers to, the relation of air to heat had received the experimental examination of Dalton, Leslie, Gay-Lussac, Thenard, and Collodon, and the mathematical investigation of Laplace, Poisson, Ivory, and others. I regret that the nature and limits of this article do not permit me to enter into a detailed account of the interesting labours of these ingenious and learned men; but I will state that the published accounts of the experiments and deductions of several of them, furnish data much nearer the truth than those obtained by Professor Smyth, though he made his experiments with apparatus possessing the very important advantage of being "on as large a scale as could possibly be desired." But the experiments and investigations, with the obtained results of most of these co-labourers in this department of science, were referred to by me in an essay, almost as elaborate, and quite as impracticable, as that of Professor Smyth's above-mentioned, (written in 1841, and published in the *Southern Quarterly Review* in 1842), on the "Refrigeration and Ventilation of Cities."

In all human inventions of any importance, success is never attained but over numerous failures, and not the least of the benefits they are capable of conferring on society, consists in exhibiting the progressive intellectual operations by which the causes of failure are removed, and they are finally made perfect. Claiming to be the only person who has rendered the application of expanding air to the production of artificial cold really useful, I must be permitted to offer a brief history of the steps by which the invention was first connected with, and then carried beyond, the known boundaries of discovery. There are witnesses living who can testify to having seen me make experiments on this subject as early as 1838; but I cannot claim that I demonstrated the production of ice, at least in contradistinction to frozen vapour or snow, as a result of the expansion of air, till 1842. In 1844, I devised, built, and exhibited a machine, by which I was enabled to show the probable equality of the heat and cold produced by the condensation and expansion of the same quantity of atmospheric air. This machine consisted, as in all my attempts at the production of artificial cold, of two double-acting pumps, one for effecting the condensation of air, the other for admitting its expansion—made to work horizontally in two cisterns. By the water in one, the heat of the condensing air was to be extinguished; and from that of the other, the heat of fluidity was to be absorbed by the cold of the expanding air. Its construction was fully described in the course of a series of essays on the "Prevention of Malarial Diseases," published in the columns of the *Commercial Advertiser*—a newspaper of the city in which I live—in the months of April, May, and June of that year.

On trial with this machine, it was found that conduction of temperature through the walls of pumps was too slow a process for the application of the principle to commercial purposes. To overcome this difficulty, a plan was contrived for introducing jets into the interior of the pumps; which, in the ensuing year, was applied. By means of these jets, both the heat of condensation and the cold of expansion, which previously occupied, in their neutralization, a number of minutes for every stroke of the pumps, were extinguished as fast as generated; and thus the motion of the pumps could be repeated with any required frequency. Though there was still that imperfection of the machine, both in plan and construction, incidental to a first experiment, yet the addition of the jets rendered it sufficiently complete to enable me to verify the principle, and set at rest the question of its remunerative value as a producer of ice.

At this time a number of causes concurred to keep the subject in abeyance for several years. Living in a frontier town, remote from cities where the mechanical arts required for the construction of such a machine are practised, and depending for the means of subsistence upon a discharge of the duties of a laborious profession, I was only able to devote to experiments short and irregular intervals of time; and after building the above-described machine, pecuniary restraints operated to render them shorter and farther between each other. Moreover, that feeling of satisfaction which is experienced by every lover of nature on discovering a new law and verifying a new principle, conjoined with the mental exhaustion produced by a long and troublesome preparation for, and prosecution of experiments, tended to render me content with what I had accomplished.

But in the early part of the year 1848, I planned another machine. with all the improvements which three years of reflection had enabled me to discover; and had it built, in the course of the summer, at Cincinnati. That machine, though rudely constructed, and somewhat less perfect in its dimensions and proportions, than one that might be built at the present day, nevertheless afforded as complete, beautiful, and successful experiments, as were ever made on such materials as air and heat. When first received from the hands of the builders, it was found. after allowing for unavoidable though comparatively trivial losses of the frigorific principle from radiation and the heat generated by mechanical friction, capable of making ice in quantities that proved the cold of expanding and the heat of condensing air were precise equivalents of each other. Circumstances compelled me to leave this machine in the hands and under the control of another man, who, though as incapable of understanding its principle or mode of operation, as a mole of comprehending the motions of the planets in the universe, yet, with the presumption characteristic of ignorance, undertook to improve it; and, as a consequence, the principle was perverted, and the machine soon destroyed. A detailed description of the construction and mode of operation of this machine was written by a friend, and published in the *Scientific American* of September 22, 1849 (vol. v. p. 3), and published. in the course of the same year, in several European scientific journals.

Having thus shown that Professor Smyth's device is incapable of pro-

ducing cold from the expansion of atmospheric air—that any power it possesses as a refrigerator, is due solely to evaporation—and that, considered as a "practical fact," it is not of so "ripe years" as either the machine I have invented, or the accounts I have published of the principles on which it is constructed, I must now take some notice of the plan which you say "Sir J. F. W. Herschel proposed four or five years ago, as practically applicable to the manufacture of ice on the great scale." I grieve to say anything tending to derogate in the slightest degree from the merits of one so eminent in the scientific and literary world as this gentleman. In common with the rest of the world, I feel the high respect due to one who has done so much in various ways, and particularly by his accomplished treatise 'On the Study of Natural Philosophy,' to lay open to all mankind the means of acquiring a species of knowledge, previously limited to the few who were favoured with a systematic education; and besides, I owe to him an individual obligation which will be hereafter mentioned. But in connecting his name with a claim to priority in inventing a machine for making ice by the expansion of atmospheric air in the manner described, he is made to signally violate one of his own precepts. So far is his plan from being, as you think, similar to mine, it, in fact, has no affinity to it; but is identical in principle, and subject to all the objections, which are attached to Professor Smyth's. The contrivance proposed in his name disregards his own excellent rule, "not to attempt what is in itself possible, by inadequate means." Hence, like the projector, (to whom he refers to illustrate this rule), who, from the inflammable character of one of the constituents of steam, and the property of a powerful supporter of combustion in the other, thought that, by directing it into a furnace, it would increase the fire to tenfold fury, and discovered that it simply blew it out ('Study of Natural Philosophy,' p. 35, American Edition). Sir John Herschel would find, on experiment, that condensed air set free on his plan, instead of "producing ice *ad libitum*," &c., would simply blow water away; or if it produced ice, it would be in the minute quantity due to the refrigerative accompaniment of evaporation.

It has excited some surprise in this country, that a countryman of the immortal Bacon, and the man, too, who is ranked as the ablest defender and expositor of his method of acquiring knowledge, should seem to have abandoned him, and to have preferred (in, I trust, this solitary instance) the Descartean notion, that, in establishing scientific principles, facts are of minor importance, in comparison with the deduction of effects from causes.

But though Sir J. Herschel has neither anticipated my invention, nor proposed one that would be useful in manufacturing ice, yet I acknowledge that I am indebted to him for a suggestion that was indispensable towards rendering my own device valuable. While investigating this subject, I found, in a note appended to his admirable discourse before mentioned (p. 250, American edition; quoted by me in my essay of 1842), my attention directed to the importance of extinguishing instantaneously both the heat of condensing, and the cold of expanding air in my contrivance. Although the subject and object of the note have no more apparent connection with the present one, than the Georgium Sidus of his illustrious father has with the earth, yet, without the addition of the jets, it was the means of suggesting that no device on this plan for making ice could be profitable; but with it unlimited, quantities may be made at a cost greatly within the ability of most of the inhabitants of a tropical country to pay for such a luxury.

In your effort to establish a claim to the invention of a machine for making ice from expanded air prior to mine, you add:—"It is also on record, that our early locomotive engineer, Trevithick, actually made some ice machines of this kind." Trevithick, it is well known, was an able practical engineer, entitled to all the laurels he gained; but these were so abundant, that he "needs not a single leaf belonging to another to complete his chaplet;" and if he has a claim to one in this instance, it is to be regretted that you do not cite volume and page in which it is to be found, so that we might be able to judge for ourselves of its worth. The moral evidence in connection with the subject is adverse to any such claim. In the first place, the pecuniary value of a perfect application of the refrigerative principle of expanding air to the production of ice is so great, that a neglect of any one to avail himself of its advantages, affords *prima facie* evidence that it is not understood by him. Again, the influence of an invention illustrating the quantity and intensity of the cooling power of expanding air, over the comfort and prosperity of a large portion of the human race, would have insured Trevithick, if he had understood and made public its principles of construction, a higher offering of grateful admiration than he has derived from the invention of the locomotive. Further, unwilling as mankind are to incur the responsibility of adopting novelties in industrial science, and slow as their progress invariably is, the natural benevolence or cupidity of man would, if its advantages had been known to Trevithick, have long since introduced it into every colony of both the British East and West Indies. And yet many years, teeming with the efforts directed to this object of men of exalted abilities, have passed away since the death of Mr. Trevithick, without reference to any labours of his, or without anything appearing to vindicate their or his claim to the invention of a useful device for diminishing the suffering caused by high natural temperature. Indeed, it may be asserted that, until last year—when a spurious, crude, and preposterous imitation of the machine made by me, and shown to the public at New Orleans in 1845, was surreptitiously built and patented in England—there was not, within either the European, or vast intertropical empire of Great Britain, an instrument capable of manufacturing ice by the expansion of condensed air.

To render apparent to the senses all the cold which atmospheric air is capable of affording, it is indispensable that its mechanical and expanding forces should be extinguished within the same space. This is a fundamental principle of success, utterly incompatible with an expansion taking place in communication with the atmosphere, or any other elastic fluid. Considered in connection with this fact, all the nice reasoning which Professor Smyth employs against the expediency of utilising this mechanical force, resolves itself into the question, whether or not it is worth while to attempt to procure artificial cold by means of the atmosphere. I have abundantly shown that, with his views, both theoretical and practical, the question must certainly be answered in the negative; but it will be seen, from the slight notice you have taken of the construction of my machine, that it depends upon principles so radically different as to warrant the opposite conclusion. In my device, therefore, instead of allowing the expanding air to diffuse its mechanical force over an indefinitely large space, I do not suffer it to exceed, or indeed to quite equal, that it occupied before condensation; and in this way I am enabled to derive from it an expansive action, similar to that of steam in its most advantageous application to mechanical purposes. The power thus reclaimed I apply to the condensation of more, or recondensation of the same air. Again, instead of wasting the refrigerative principle in an atmospheric ocean, I transfer it, by means of the jets before mentioned, to a liquid uncongealable, and having a great capacity for, and comparatively stable relations with, caloric. As a corollary to these principles of construction, my device is adapted to admit of a return of the condensed air to a tension neither greater nor less than it possessed before condensation. It will be evident, upon a careful reflection on the varying relation of air to heat, under different degrees of condensation, that not only will the machine be efficacious in proportion as this adaptation is accurate, but that very slight deviations from accuracy will materially diminish the quantity of cold a machine is capable of producing, while it will greatly increase the demand for power to work it. These indications constitute the object, as their fulfilment forms the peculiarity, of the machine I have invented for the artificial production of cold.

The principles involved in the process are as simple as any within the range of physical science, but let it not be supposed that the construction of a machine for developing them is within the capacity of every one whose cupidity or presumption may urge him to the undertaking. In addition to a knowledge of the laws of mechanical force applicable to elastic fluids, its successful execution requires an intimate acquaintance with the peculiar relations of air to heat I have discovered. To enable us to obtain all the cold the principle is capable of affording with the highest degree of economy, the machine must be adapted to meet the habitudes of air under variations of natural temperature, and even the changes of barometric pressure. No mechanical contrivance, since the great improvement of the steam-engine by Watt, and the invention of the vacuum pan by Howard, has been offered to the world, which requires a nicer adaptation of science to art to render it useful. A perfect instrument should unite the mathematical accuracy of the mural circle, and the strength of the steam-engine. That simplicity and coarseness of machinery which Professor Smyth speaks of, as admitting of being managed at comparatively little cost by an uneducated West Indian negro, a Hottentot, or a Hindoo, would be as useless as cheap; but, on the other hand, the abundance of ice which the more complex structure I propose would make, holds out a rich prospective remuneration for the employment of the highest order of engineering talent.

I have now fully shown, I think, that in your view of the nature of my invention, and in your correspondent Professor Smyth's exposition of the practicability of his machine to produce artificial cold, both have erred in every branch of the arguments adduced. I have shown that the peculiar laws of atmospheric air in its relation to heat, require, for the production of cold from its expansion, a peculiar construction of machine, which, so far as published to the world, mine alone has attained. The instrument I have devised and built, has demonstrated a capacity to produce ice in a tropical climate in vast quantities, at

practically a scarcely appreciable cost beyond its first cost, and therefore it cannot be identical with Professor Smyth's, which I have shown must be a delusion and a nullity. It follows, then, that (his machine being alluded to) it cannot be accurate to say, an invention for the artificial production of ice on a large scale, by the expansion of condensed atmospheric air, has been long since a practical fact in Great Britain; and I am warranted in repeating my assertion, that unless the imitation of my invention before mentioned be in operation, there is none in use at the present time. Aware of the great merits of the *Practical Mechanic's Journal* as a scientific periodical, and of the industry and talents of Professor Smyth, I regret that I have found so much in the brief notice of my labours by you, and in the unfounded pretension by and on behalf of him, to refute. But as I am persuaded that the deviations from accuracy I have pointed out were unintentional, and that the discovery and establishment of truth are the real objects of both, I feel that I need not apologize for this free and plain discussion of the subject.

Apalachicola, Florida, August, 1852.

[In devoting five pages of our space to Dr. Gorrie's communication, so strongly condemnatory of the joint opinions and statements of Professor Smyth and ourselves, and, last but not least, Sir John Herschel, we trust that, however much we may have erred in the sight of our readers, we have at least the credit of lending a willing ear to the remonstrances of a foreign philosopher, and have not utterly overlooked the justice of this passage in his introductory letter:—

"I respectfully ask the publication, in your Journal, of the accompanying communication. It has been written, not so much, as it would seem to import, in reply to your notice in Vol. III. of my invention, as to make that notice a convenient vehicle for introducing the subject to the British public.

"I feel the less hesitation in making the request of you to publish the article, because I know, whatever may be its defects of style and arrangement, it contains enough of philosophy—both new and good—to claim a place in a scientific Journal, and to interest its readers.

"It appears that distinguished Englishmen and I differ very materially in our views both of the philosophy and the facts involved in the subject; but I trust that national feeling will not be suffered to interpose an objection to so important a means of eliciting truth as the publication of my essay may afford. It was a countryman of yours (a writer in the *Edinburgh Review*) who taught the world the noble maxim, 'That the commonwealth of science is of no nation, but is a republic comprising the whole earth, in which truth and justice are the paramount principles of government.' To disregard this maxim would be to retard the advance and prosperity of mankind, and (though I know I am committing an act of supererogation by reminding you of the fact) would reflect as much discredit on the party so acting, as it would be calculated to inflict injury upon him against whom it operates."

Dr. Gorrie has rightly judged of us, that "national feeling" will have nothing to do with the matter between us; for *we* have also read in the works of another illustrious countryman of our own, that "Science, the partizan of no country, but the beneficent patron of all, has liberally opened a temple where all may meet. She never inquires about the country or sect of those who seek admission—she never allots a higher or a lower place from exaggerated national claims, or unfounded national antipathies. Her influence on the mind, like that of the sun on the chilled earth, has long been preparing it for higher cultivation and further improvement. The philosopher of one country should not see an enemy in the philosopher of another; he should take his seat in the temple of science, and ask not who sits beside him."*

But before proceeding to our own reply, let us see what Professor Smyth says as to his share of the question:—

"The printed proof of Dr. Gorrie's paper on 'The generation of cold by the expansion of atmospheric air artificially compressed,' I have read with much interest, as describing his labours in a similar field with my own—a field, too, which I am inclined to think of vital importance to the well-being of our race in the warmer parts of the world. I was also interested in the paper, as being the inventor's *own* account of his proceedings.

"That an inventor's tale should be told by himself, even Dr. Gorrie unwittingly manifests; for when he attempts to describe and discuss my contrivances for ends similar to his own, he represents them in so very erroneous a manner, that, disliking on principle all scientific controversy, I must request those of your readers who wish to judge for themselves, to refer to my own paper (Vol. III. *P. M. Journal*) for the real nature of my machine, and the principles upon which it is founded.

"*Edinburgh, November*, 1852." "C. Piazzi Smyth."

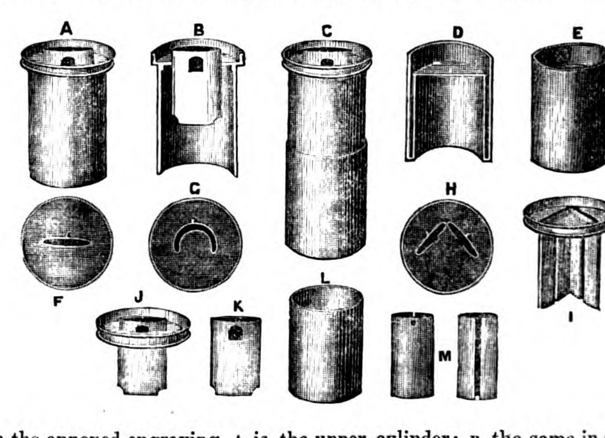
Now, without committing ourselves to an imitation of Dr. Gorrie's prosaic tendency, we may at least compare the respective purposes of the two machines. Dr. Gorrie's machine makes ice—Professor Smyth's cools air to fit it for agreeable respiration. Are they then different in principle, seeing that the production of "cold" is arrived at in both cases? Both employ mechanical force in compressing their raw material—the air; both deprive it, when so compressed, of its resultant heat of compression—and both then let it expand. In Professor Smyth's machine this is all, and theory and experiment have combined to enable him to state the quantity of air per hour and per horse power that can be cooled in this way a certain number of degrees, whilst he has actually furnished drawings of his apparatus. But Dr. Gorrie (in paragraph 8) tells us that this influence is nothing—that, whether the heat of compression is removed or not, the expanding air will issue at the same temperature!—an opinion in which, he candidly confesses, he stands alone in the world, no one knowing anything of the laws of air and heat but himself. And further, he tells us that the expanding air produces cold solely by evaporation. But we plainly assert that he *does* employ the same principle of expanding air as Professor Smyth, though he may use it only indirectly, by passing the air over a fluid. As to any additional effect obtainable from the evaporative process, he gives us no means of judging, neither does he give us any drawings, nor any clear or precise account of the actual machine which he has constructed. And, lastly, he tells us nothing of the quantity of mechanical power consumed in making a given weight of ice.

Again, what has been the relative practical success of the two systems? Professor Smyth cannot afford to put his designs into execution himself, and both her Majesty's Government and the East India Company have declined to render any assistance in carrying out the plan, although of such vast importance to the lives of their servants, and so desirable as a means of preventing the drain upon the public purse in the colonies. But a committee of the British Association was, however, appointed at Belfast, last September, to urge the matter again upon the Government.

On the other hand, Dr. Gorrie states that he had a serviceable machine made so long ago as 1848, producing vast quantities of ice for commercial purposes. But we cannot deal with such general terms. He ought to state *what* quantity of ice has been so made, and at what expenditure of power. We should also like to know at what price the ice can be sent into the market—if it has been so furnished—and to what extent? Also, how much the engine costs for attendance and repairs? and how long it has worked continuously? Pending the replies to these questions—and we trust that Dr. Gorrie can give them—we can but consider the practical success of his method to be measured by the same slight standard which he has applied to that of Trevithick. We may, indeed, re-echo Dr. Gorrie's inquiry, "Has it been introduced into any colony of the British East or West Indies?" He confesses that it has not—even in boasting that his one-constructed machine is the only one existing in the world, up to the present day, capable of making ice in large quantities.—Ed. *P. M. Journal.*]

THOMSON'S SLUSH LAMP FOR NIGHT SIGNALS.

Since we published the general views and particulars of this valuable contrivance,† it has been most successfully introduced into the navy, having found high favour in the sight of the Lords of the Admiralty, through the energetic exertions of Mr. Thomson, who has devoted considerable care to the perfection of the details, which we now furnish.



In the annexed engraving, A is the upper cylinder; B, the same in section, showing the wick-tube holder; C is the lamp trimmed ready for

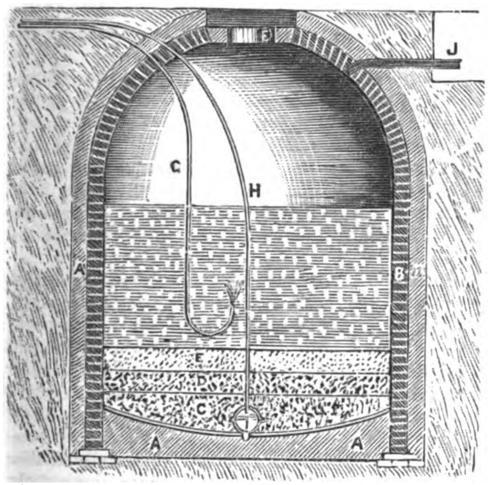
* Lawrence's Lectures.

† Page 84, *ante*.

use; E, the lower cylinder; D, the same in section, showing an inner cylinder, with a leather plug at the top, fitting the cylinder, A, and serving to force the grease upwards as required; F, G, H, are the tops, with differently shaped tubes for varying the flame—F being for a single tube, G for a horse-shoe shaped one, and H for two tubes; I and J are double and single tube-holders, with rims; in J are two small holes at the bottom, to admit grease, and one at the top, which is half above and half below the rim; K is the same, without the rim; L is a can or cylinder, instead of E, when oil is used; and M shows the construction of the wick-tubes.

THOMSON'S RAIN TANK.

We hear much, and yet much too little, of the importance to health and comfort of an ample supply of good water for the great population centres of the empire; but there are numerous suburban situations, and, indeed, whole districts of country, in which the scarcity of this necessary of life is nearly as severely felt as in the metropolis itself, and yet we hear of no tangible suggestion for alleviating the evil. It appears, however, by *experiment*, that the remedy is sufficiently easy in all localities where rain falls in average abundance.



A, A puddle wall, 9 inches thick.
B, A brick wall, 9 inches thick.
C, Filter stratum of pure charcoal.
D, Filter stratum of sand and charcoal.
E, Filter stratum of pure sand.
F, Manhole, cut in the keystone of the cupola.
G, Supply-pipe from the roof gutters.
H, Pipe leading to the draw-off pump.
I, Pure water receiver, in which the lower end of the pipe, H, terminates.
J, Waste or overflow pipe.

Mr. Thomson of Bellfield, a retired Glasgow merchant, possessing a full share of the intelligence and energy of his class, happened to have his attention drawn to this subject upwards of twelve years ago, when he became the proprietor of some villa lands in the neighbourhood of Kirkintilloch; and he has succeeded in fully solving the difficulty. It was found that an adequate supply of good water for domestic purposes could not be easily obtained in the usual way—by digging wells. He was therefore led to consider whether a proper supply could not be had otherwise—whether it might not be practicable to collect the rain water received on the roofing of the house for which the supply was required, and store and purify it for the use of the occupants. Aware that the average quantity of rain which falls annually in that locality is about 36 inches, a very little calculation sufficed to show that this amounts, on an area of 50 feet square—contained in the roofing of the villa which he himself occupied—to no less than 46,800 imperial gallons in the course of a year; and that, with proper means for receiving and storing the water as it falls, he might thus obtain a daily supply of 128 gallons.

He further calculated, from the average monthly falls of rain, as shown by the rain-guages in the neighbourhood, that a circular tank of 12 feet diameter, and of equal depth, would have sufficient capacity for receiving all this supply of water, supposing the daily consumption of 128 gallons to be regularly drawn off. He proceeded, accordingly, to carry out his scheme of collecting the water, and an experience of twelve years has fully justified his expectations.

A suitable situation for the tank having been chosen, he had a pit dug to the depth and diameter of 15 feet, so as to allow of 9 inches of puddle and 9 inches of brick wall, with 12 feet diameter of capacity for water. But instead of continuing the wall cylindrically to the whole height—which implied some expense and inconvenience in covering the tank—it was deemed advisable to terminate the building with a dome. Accordingly, thoroughly well-burned bricks of the proper forms were prepared, 9 inches long, 6 inches broad, and 3 inches thick at their smaller ends, and moulded to the given radii, so that the wall might everywhere oppose the strength of an arch to external pressure. The building was finally terminated by an annular stone, cut into this form, that it might at once serve as a key to the dome, and maintain a permanent *manhole*, by which access could at any time be had to the interior of the tank. This manhole could be covered with a flat stone, removeable at pleasure.

The tank having been constructed in accordance with these considerations of economy and durability, and the bottom of it floored with 9 inches of puddle, and covered with well-burned tiles, 1½ inch thick, the next subject of consideration was the best mode of purifying the water from such extraneous matters as it might be supposed to carry with it from the roof gutters of the house. The following is the mode which was adopted:—An earthenware receiver, formed of two flanged capsules, was procured, and placed at the bottom of the tank, and concentric with it. One of the capsules, purposely made with a nipple projecting from its convex surface, is partially embedded in the puddle, with the concave side upwards; and the other capsule, formed with a flange, about 9 inches deep, rests loosely upon it. The two capsules together thus form a receptacle for pure water, which is admitted into it by small openings between the two flanges. A pipe, of 1½ inch bore, is inserted into an aperture left for it in the body of the upper capsule, and serves to connect the interior of the receiver with a pump of ordinary construction, by which the water is drawn off for use, as required.

This receiver is surrounded and covered by a filtering bed, consisting of charcoal and sand in three layers, and through which the water must accordingly pass before it is drawn off by the pump. The undermost layer consists entirely of well-prepared wood charcoal, broken into pieces of about an inch guage. The layer over this is composed of charcoal-dust and clean sand, intimately and carefully mixed; and the uppermost layer consists entirely of pure sand. These layers are each 12 inches deep, so that the entire filter bed has a depth of three feet.

The interior of the tank is connected with the gutters of the roof of the villa by a pipe of 1½ inch bore, by which all the water of every passing shower is immediately transferred to the tank, without any considerable loss by evaporation. Another pipe is inserted near the mouth of the tank, to form a communication with the external atmosphere, and to serve as a *waster*, in case the supply of water is at any time so great as to overflow the tank.

These are the essential details of the construction; and it is sufficiently obvious that they include all the elements of durability and efficiency, combined with economy. The total cost, including the necessary pipes and pump, did not exceed £20; and the uphold expense, during the twelve years the tank has been in operation, has not been more, on an average, than a shilling a year. The expectations which led to the adoption of the scheme has, besides, been most fully realised. The supply of water has hitherto been ample for all the purposes of the occupants of the villa; and in quality it is unsurpassed by any spring water in the world. It is limpid as crystal, perfectly free of odour and taste, singularly soft, and always cool, even during the most sultry weather of summer. It is, indeed, eagerly sought after in the neighbourhood, for some of the more delicate domestic purposes, as for making tea and dissolving starch; and it is even employed by some of the medical practitioners in the locality as a substitute for distilled water. Much of this purity is of course due to the care with which the filtering materials were originally prepared—especially the sand, which was not only carefully washed, but was also selected of a quality as free as possible of iron and any other ingredients likely to dissolve in the water.

It can scarcely be doubted, from the success of the rain tank in this instance, that it might be employed with certainty in numerous situations where water is either insufficient in quantity or indifferent in quality; and even in very many cases where underground water is abundant, it would undoubtedly be a cheaper and more convenient mode of obtaining the requisite supply than by sinking wells. It may, indeed, be affirmed, that there is not a tenth of the dwelling-houses of Europe which do not receive on their roofs, in the course of each year, as much water, in the form of rain, as would amply suffice for all the ordinary domestic purposes of their inhabitants, provided it were collected and economised in the way described. Even the famous Crystal Palace might obtain an abundant supply of fresh water for all its contemplated purposes by the same means. Its roof is said to contain an area of eighteen acres; if, therefore, all the rain water which will fall upon it in the course of a year were thus collected and purified, it would give, at the London average of 32 inches of rain-guage depth, over 13,000,000 gallons, equal to a daily supply of no less than 35,616 gallons for the purposes of the establishment.

β.

METZ' IMPROVEMENTS IN BLEACHING AND DYEING.

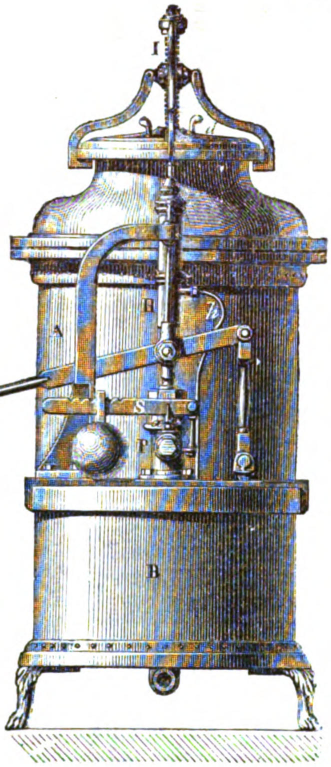


Fig. 1.

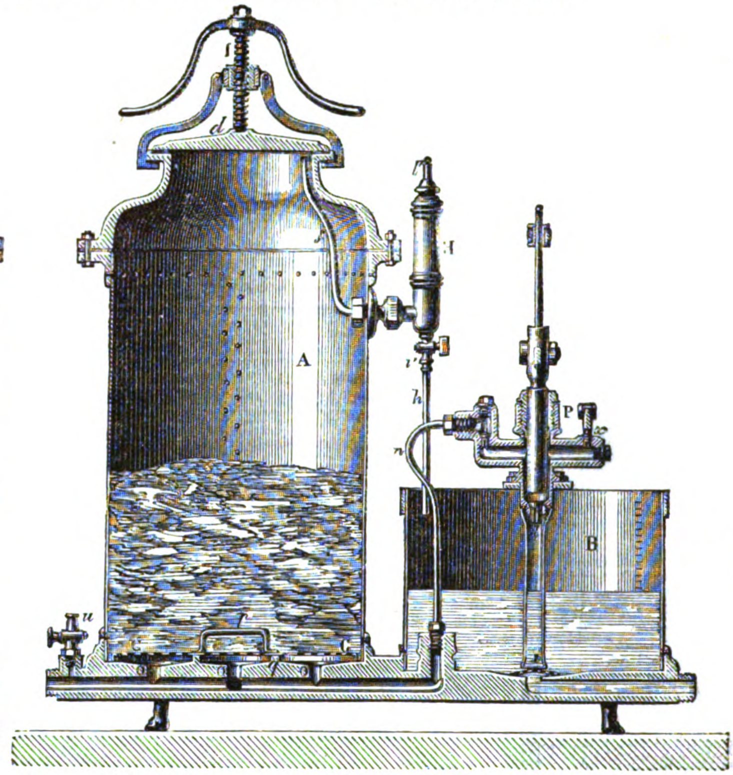


Fig. 2.

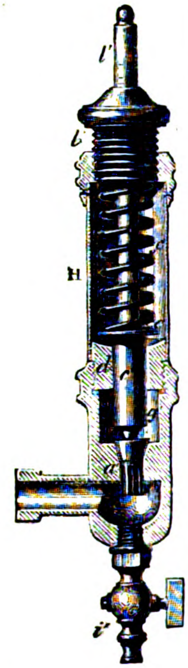


Fig. 3.

It has been hitherto supposed, that in order to prepare cotton fabrics for bleaching and dyeing, it was necessary to boil the goods for a considerable time, with the avowed intention of separating any oily or resinous matters existing in the filaments of the cotton. Various experiments have, however, led M. Metz, an engineer of Heidelberg, to the conviction, that the office of the boiling is simply to expel the air from amongst the fibres—the air being, indeed, the real obstacle to the due bleaching or dyeing effect. Such expulsion of the air he considers to be effected partly by the pressure due to the heat, and partly by the mechanical action and agitation due to the ebullition. Hence he proposes to improve the system of treatment, by substituting a pressure obtained in a simple manner. The apparatus he uses is represented in our three engravings annexed.

Fig. 1 is an end elevation of the arrangement, and fig. 2 is a vertical longitudinal section corresponding. The materials under treatment are placed in the closed receiver, A, and the water used as the medium whereby the air is expelled, is contained in the open vessel, B. Both these vessels are cylindrical, and formed of tin or copper plates, and attached to one foundation casting. The larger vessel, A, is fitted with a perforated false bottom, C, which serves to prevent the obstruction of the passages, *o o*, this bottom being slightly convex, and capable of removal by the handle, *p*. The vessel, A, is closed by the cover, *d*, which is retained in position by the bridle and screw, I. The expelled air finds an exit by the pipe, *f*, which communicates with the interior only at the very top, in order that all the air may be expelled before any water can find its way out. This pipe communicates with the combined regulator and indicator, H, as in fig. 3, which is a vertical section of this detail, on an enlarged scale. On a support, running across the top of the vessel, B, the pump and its appurtenances, P, are fixed, and this, by means of the suction-pipe, *l*, pierced with holes at *i*, but otherwise closed to prevent the entrance of improper substances, draws up the liquid, and forces it through the pipe, *n*, and passages, *o o*, into the large receiver, A, as well as into any other with which it may be in communication, as shown by the continuation of the passage. A safety-valve, *x*, with its weighted lever, *s*, is also attached to the pump.

The combined regulator and indicator, H, contains a conical valve, *a'*, which, in rising, presses against the lower end of the piston, *c'*. This works in the socket, *d*, above which it has a collar, *e'*, whereby it receives the pressure of the helical spring, *f*; and this spring abuts against the top, *b'*, screwed into the indicator cylinder, but formed with a central opening for the passage of the piston-rod, *l*, graduated externally, to show the degree of internal pressure. Before the air can escape, it must raise the valve, *a'*, but it cannot do so until it has attained the pressure determined by the adjustment of the spring, and it thereafter passes off by the pipe, *h*, shown more plainly in fig. 1. A small cork, *i'*, is attached to the bottom of the indicator, for cleansing it, and for drawing off any water.

The procedure is very simple: The indicator is adjusted to maintain a pressure inside the receiver, A, to clear off the air from the material under treatment in it. Water is then forced in by the pump until all the air escapes, and the material is then in a fit state for bleaching or dyeing. M. Metz has experimentally found, that water may be continued to be pumped through the material under treatment, even after the air has all escaped, as a beneficial cleansing effect is thereby produced. A weak solution of lime may also be employed advantageously, as, for instance, when it is intended to dye the material with indigo in a cold state.

M. Metz states that his experience with the new apparatus has given very satisfactory results. Where, by the ordinary process, an hour and a half or more boiling is necessary, he can produce a better effect in forty minutes, avoiding, at the same time, the expense of fuel, always a very considerable item. Besides this, the cotton so treated escapes the injury to its fibre due to the boiling process; indeed, the quality seems to be greatly improved.

MECHANIC'S LIBRARY.

Algebra, Elements of, 18mo, 1s. 6d., sewed. Rev. J. W. Colenso.
Architects, The Age and its, 2nd edition, 12mo, 3s. 6d., cloth. E. P. Hood.
Architecture, Rural, edited by Fyfe, imp. 8vo, 21s., cloth. Gray.
Art and Architecture, Progress in, 4to, 21s., cloth. J. P. Seldon.
Chemistry, Household, new edition, foolscap 8vo, 4s. 6d., cloth. A. J. Bernays.
Chimneys, Practical Treatise on, post 8vo, 5s., cloth. G. F. Eckstein.
Differential and Integral Calculus, 2nd edition, 8vo, 9s. Hemming.
Differential Calculus, crown 8vo, 10s. 6d., cloth. Todhunter.
Engineering, Agricultural, Part 2, 12mo, 1s., cloth. Andrews.
Hints to Inventors intending to obtain Letters Patent, 8vo, 6th edition. W. & J. H. Johnson.
Imitative Art, Principles of, post 8vo, 6s., cloth. G. Butler.
Machinery, Architecture of, 4to, 6s., boards. S. Clegg, jun.
Microscope, Curiosities of the, square, 6s. 6d., cloth. Rev. J. H. Wythes.
Patent Law Amendment Act, 1852, Abstract of, 8vo, 6d. W. & J. H. Johnson.
Patents for Inventions, Law of, 5th edition, 2s. 6d., cloth. W. Carpmael.
Science and Literature, Readings in, 2nd edition, 3s. 6d. Scrymegour.
Science, Marvels of, 2nd edition, crown 8vo, 10s. 6d. cloth. S. W. Fullom.
Water, On the Contamination of, by Lead, foolscap 8vo, 3s. 6d. Harrison.

METEOROLOGICAL TABLE,*

FOR THE QUARTER ENDING SEPTEMBER 30, 1852.

THE OBSERVATIONS HAVE BEEN REDUCED TO MEAN VALUES BY GLAISHER'S TABLES, AND THE HYGROMETRICAL DEDUCTIONS HAVE BEEN MADE FROM GLAISHER'S HYGROMETRICAL TABLES.

NAMES OF THE STATIONS.	Mean Pressure of Dry Air reduced to the Level of the Sea.	Mean Temperature of the Air.	Highest Reading of the Thermometer.	Lowest Reading of the Thermometer.	Mean Daily Range of Temperature.	Mean Monthly Range of Temperature.	Range of Temperature in the Quarter.	Mean Temperature of Evaporation.	Mean Temperature of the Dew Point.	Wind. Mean Estimated Strength.	Wind. General Direction.	Mean Amount of Cloud.	Rain. Number of Days on which it fell.	Rain. Amount Collected.	Mean Weight of Vapour in a Cubic Foot of Air.	Mean additional Weight required to Saturate a Cubic Foot of Air.	Mean Degree of Humidity.	Mean whole Amount of Water in a Vertical Column of Atmosphere.	Mean Weight of a Cubic Foot of Air.	Height of Cistern of Barometer above the Level of the Sea.	NAMES OF THE OBSERVERS.
	in.	°	°	°	°	°	°	°	°					in.	gr.	gr.		in.	gr.	feet.	
Jersey	29·479	62·3	88·0	45·0	16·4	32·3	43·0	59·6	57·5	1·8	N.W. & S.W.	3·8	35	9·3	5·4	1·0	·844	6·5	524	85	Rev. S. King, F.R.A.S., M.B.M.S.
Guernsey	29·464	60·9	80·0	49·0	10·6	22·3	31·0	59·3	58·0	1·2	N.E. & S.W.	4·4	30	12·3	5·5	0·6	·913	6·6	524	123	Dr. Hoskins, F.R.S., M.B.M.S.
Helston	29·489	61·8	85·0	47·0	18·1	32·0	38·0	58·0	55·1	1·7	S.W., E., & N.W.	4·5	35	9·0	5·0	1·2	·804	6·2	524	106	M. P. Moyle, Esq.
Falmouth	29·498	61·3	84·0	43·0	18·5	32·0	41·0	...	...	1·4	S.W., E., & N.W.	5·9	37	9·4	...	...	...	...	...	120	Lovell Squire, Esq.
Truro	...	60·8	82·0	35·0	17·0	35·0	47·0	56·6	53·3	0·4	Var.	4·9	40	9·5	4·7	1·3	·780	5·8	527	55	Dr. C. Barham.
Torquay	...	60·5	87·0	46·0	10·8	24·3	36·0	56·7	53·7	2·3	N. & S.W.	...	39	9·7	4·8	1·3	·799	5·9	...	160	Edward Vivian, Esq.
Exeter	29·509	60·5	87·0	39·0	17·4	36·8	48·0	56·4	53·4	1·5	N., W., & S.	3·3	44	10·1	4·7	1·3	·798	5·8	525	140	Dr. Shapter, M.B.M.S.
Ventnor	29·458	63·5	82·0	46·0	9·0	23·3	36·0	...	58·7	...	W. & N.W.	...	37	12·2	5·6	1·0	·856	6·5	522	150	Dr. Martin.
Newport	29·463	61·8	90·6	36·2	17·9	38·1	54·4	57·8	55·2	2·1	S.W. & N.W.	4·6	36	11·0	5·0	1·3	·800	6·2	526	15	J. C. Bloxam, Esq., M.B.M.S.
Ryde	29·469	61·9	91·0	37·4	20·2	40·2	53·6	58·6	56·1	0·2	N.E. & S.W.	5·9	34	12·9	5·2	1·1	·830	6·4	524	110	Benjamin Barrow, Esq., M.B.M.S.
Worthing	...	61·4	82·5	43·0	10·7	27·2	39·5	57·8	55·1	...	N.E. & S.W.	...	35	8·5	5·0	1·3	·816	6·2	...	25	W. G. Barker, Esq., F.R.C.S., M.B.M.S.
Chichester	...	61·4	89·0	40·0	16·5	34·0	49·0	...	56·2	...	N.E. & S.W.	...	...	9·8	...	...	...	...	...	23	William Hills, Esq.
Southampton	29·428	61·4	86·7	39·8	14·4	31·6	46·9	58·0	55·5	0·4	N.E. & S.W.	5·8	35	12·3	5·1	1·1	·829	6·2	524	60	J. Drew, Esq., Ph. D., M.B.M.S.
Uckfield	29·503	62·8	93·0	32·0	23·4	46·2	61·0	58·5	55·6	0·6	E. & S.W.	5·6	38	13·0	5·1	1·4	·787	6·6	523	180	Charles Prince, Esq., M.B.M.S.
Royal Observatory	29·512	61·8	90·3	40·9	20·1	36·4	49·4	56·7	53·0	...	N.E. & S.W.	...	32	10·7	4·7	1·6	·744	5·7	523	159	The Astronomer-Royal.
St. John's Wood	29·464	60·9	89·0	37·0	17·3	33·0	52·0	57·8	55·5	1·1	N.E. & S.W.	5·9	35	9·8	5·1	1·0	·849	6·3	524	150	George Leach, Esq., M.B.M.S.
Enfield	29·459	62·1	89·0	36·0	17·2	35·0	53·0	58·0	54·9	...	N.E. & S.W.	...	40	8·5	4·9	1·4	·780	6·1	524	76	Rev. J. M. Heath, A.M., M.B.M.S.
Rose Hill	29·493	61·2	92·3	34·2	20·9	40·2	58·1	57·7	55·2	2·3	N.E. & S.W.	6·0	39	10·1	5·1	1·2	·819	6·2	521	270	Rev. John Slatter, F.R.A.S.
Radcliffe Observatory	29·494	60·5	88·3	34·6	17·3	35·3	53·7	57·0	54·3	1·6	S.W. & N.E.	6·3	40	10·4	4·9	1·1	·824	6·0	523	210	M. J. Johnson, Esq., M.A., F.R.A.S.
Stone Observatory	29·449	60·5	90·0	35·4	19·7	40·1	54·6	56·9	54·2	0·5	N.E. & S.W.	5·0	44	10·2	4·9	1·1	·811	5·8	520	320	O. J. Grace, Esq., M.B.M.S.
Hartwell House	29·449	61·4	90·9	33·0	20·6	40·0	57·9	57·2	54·2	0·9	S.W. & N.E.	5·7	...	...	4·8	1·4	·785	5·9	521	250	Dr. Lee, F.R.S., Trea. B.M.S.
Hartwell Rectory	29·419	60·6	89·8	35·0	18·1	36·6	54·8	58·6	57·1	0·7	S.W.	5·8	43	9·5	5·4	0·7	·890	6·6	520	290	Rev. C. Lowndes, M.A., F.R.A.S., M.B.M.S.
Aylesbury	29·502	61·4	91·5	31·0	20·1	42·3	60·5	57·7	55·1	0·6	N.E. & S.W.	5·9	39	9·3	5·0	1·4	·814	6·2	522	284	Thomas Dell, Esq., M.B.M.S.
Linslade	...	60·4	91·0	34·0	21·4	...	57·0	56·5	53·6	...	N.E. & S.W.	...	42	10·8	4·8	1·2	·797	5·8	...	313	J. Osborn, Jun., Esq., M.B.M.S.
Royston	29·520	61·4	89·9	37·0	19·1	37·2	52·9	57·2	54·1	...	Var.	6·0	60	10·1	4·8	1·4	·785	5·9	522	271	Hale Wortham, Esq., M.B.M.S.
Cardington	29·477	60·8	91·0	34·4	16·0	37·8	56·6	57·2	54·6	0·8	Var.	5·8	38	9·8	4·9	1·2	·815	6·1	525	100	S. C. Whitbread, Esq., Pres. B.M.S.
Bedford	...	61·0	91·5	35·0	18·8	38·0	56·5	57·3	54·6	0·8	Var.	5·2	45	11·6	4·9	1·2	·811	6·1	...	100	Dr. Barker, M.B.M.S.
Norwich	29·457	60·9	84·0	36·0	15·9	33·8	48·0	57·7	55·5	1·6	S.W. & S.E.	5·9	32	9·5	5·0	1·1	·842	6·2	526	39	W. Brooke, Esq., F.R.A.S., M.B.M.S.
Grantham	29·489	59·8	91·3	36·0	16·4	36·0	55·3	56·5	54·0	light.	S.W. & N.E.	5·7	38	12·7	4·8	1·0	·823	6·0	523	190	J. W. Jeans, Esq., M.B.M.S.
Derby	29·498	61·2	88·0	35·0	...	35·3	53·0	56·2	52·8	...	Var.	...	44	10·6	4·6	1·6	·760	5·7	525	100	John Davies, Esq., M.B.M.S.
Holkham	29·453	61·0	93·7	35·8	19·2	39·8	57·9	58·2	56·2	0·9	N.E. & S.W.	5·4	33	9·4	5·2	1·0	·857	6·3	526	39	S. Shellabear, Esq., M.B.M.S.
Highfield House	29·436	60·9	91·0	32·0	21·2	41·2	59·0	57·4	54·9	0·2	N.W. & S.W.	6·2	45	12·0	5·0	1·1	·814	6·1	524	103	E. J. Lowe, Esq., M.B.M.S.
Hawarden	29·507	58·5	81·0	40·5	13·8	28·8	40·5	55·8	53·7	1·4	N.W. & S.W.	6·1	39	12·4	4·8	0·9	·853	5·9	524	260	Dr. Moffat, F.R.A.S., M.B.M.S.
Gainsborough	29·482	60·0	95·5	38·0	18·8	37·7	57·5	56·4	53·6	0·1	N.E. & S.W.	4·0	39	8·3	4·8	1·2	·809	5·9	527	30	T. Dyson, Esq., M.B.M.S.
Liverpool	29·467	61·1	80·3	46·5	10·8	23·6	33·8	58·2	56·1	0·9	N.W. & S.E.	6·3	38	9·4	5·2	1·0	·856	6·3	525	37	John Hartnup, Esq., F.R.A.S.
Wakefield Prison	29·507	59·9	93·5	31·0	21·4	43·8	62·5	55·4	52·2	2·1	Var.	5·8	46	9·6	4·5	1·3	·780	5·6	526	115	W. R. Milner, Esq., M.B.M.S.
Leeds	29·504	60·8	95·0	32·0	22·6	43·0	63·0	55·6	51·8	1·8	S.E. & S.W.	6·0	46	7·4	4·5	1·6	·741	5·6	524	138	Henry Denny, Esq.
Stonyhurst	29·492	58·0	84·3	33·6	17·4	36·1	50·7	55·4	53·3	0·8	N. & S.W.	6·2	49	14·0	4·8	0·8	·867	5·8	522	381	Rev. J. Clare.
York	29·453	58·9	87·5	34·0	15·6	35·2	53·5	55·3	52·6	...	S.W. & N.E.	...	37	8·6	4·6	1·1	·813	5·7	527	50	John Ford, Esq.
Whitehaven	29·425	59·2	83·0	40·0	11·9	28·0	43·0	56·8	55·0	1·4	S.W. & N.E.	...	44	10·2	5·0	0·8	·872	6·1	526	90	John Fletcher Miller, Esq., F.R.S., M.B.M.S.
Durham	29·489	57·7	84·2	36·7	13·4	32·4	47·5	55·3	53·3	1·1	S.W. & N.	6·4	45	12·7	4·7	0·7	·866	5·8	523	352	William Ellis, Esq.
Newcastle	29·471	58·6	83·0	37·0	15·2	32·2	46·0	55·6	53·2	...	S.W. & N.E.	...	36	...	4·7	1·0	·835	5·8	526	121	G. Muras, Esq.
North Shields	...	56·0	73·5	37·5	14·1	24·6	36·0	54·5	53·2	1·9	S.W. & N.E.	5·3	53	21·2	4·7	0·5	·927	5·8	...	124	R. Spence, Esq.
Glasgow	29·477	59·2	79·8	33·5	12·1	29·4	46·3	54·5	50·7	...	W. & S.E.	...	45	11·5	4·3	1·4	·752	5·3	526	121	R. D. Thompson, M.D., F.R.S.E., M.B.M.S.
Dunino	29·495	57·7	78·0	32·0	15·9	32·0	46·0	53·2	49·4	1·6	S.W. & N.W.	3·8	26	5·3	4·2	1·4	·755	5·1	525	250	David Tennant, Esq., M.B.M.S.

The mean of the numbers in the first column is 29·476 inches, and it represents that portion of the reading of the barometer due to the pressure of air; the remaining portion, or that due to the pressure of water, is 0·425 inch; the sum of these two numbers is 29·911 inches, and it represents the mean reading of the barometer for the quarter at the level of the sea.

The highest readings of the thermometer in air were 95° 5' at Gainsborough, 95° at Leeds, 93° 7' at Holkham, and 93° 5' at Wakefield. The lowest reading was 31° at Aylesbury and Wakefield. The least daily ranges of temperature took place at Ventnor, Guernsey, Worthing, and Torquay; and the greatest at Uckfield and Leeds.

Rain fell on the least number of days at Dunino, Guernsey, Greenwich, Norwich, and Holkham; and on the greatest number at Royston, North Shields, Wakefield, and Leeds. The least falls took place at Dunino, Leeds, and Gainsborough; and the mean amount at these places is 7·0 inches. The largest falls occurred at North Shields, Stonyhurst, Uckfield, and Ryde, and their average is 15·3 inches.

* For the monthly values, see the Registrar-General's Quarterly Report.

ON THE METEOROLOGY OF ENGLAND AND THE SOUTH OF SCOTLAND, IN THE QUARTER ENDING SEPTEMBER 30, 1852.

By James Glaisher, Esq., F.R.S.,
Secretary of the British Meteorological Society.

Till 2d August the weather was hot; on 5th July, the temperature exceeded 90° at all places, excepting those situated either near the sea, or at a high elevation, and those whose latitude exceeded 54°. The mean temperature of this day was 14° in excess above its average value, and the following day was in excess to the amount of 12°. The average daily excess to 2d August was 5° 2′. From 3d till 16th August, the daily temperatures were mostly below their average; the mean defect for the period was 1° 2′. The period from 17th August till 11th September was warm, and the average daily excess of temperature was 2° 6′; from 12th September the weather was cold, and the average daily defect was 1° 9′.

The quarter has been remarkable for great heat in July; very frequent and severe thunder-storms; frequent and heavy falls of rain, and for an excess of rain. Harvest operations were much impeded by the unsettled weather in August, and the crops at most places sustained damage before they were cut, by being beaten down near the ground.

The mean temperature of the air at Greenwich was 66° 6′ in July, 62° 1′ in August, and 56° 8′ in September; *exceeding* the average of eighty years by 5° 3′, 0° 6′, and 0° 5′ respectively.

The mean temperatures of the dew point were 57° 2′, 52° 7′, and 49°, in those three months; exceeding the average of eleven years by 2° 9′ in July, and less than the average by 2° 1′ in August, and 2° 6′ in September.

The degree of humidity for the quarter was 0·744, complete saturation being represented by units; the value is 0·071 below the average of eleven years.

The fall of rain was 2·3 inches in July, 4·5 in August, and 3·9 in September; exceeding the average fall of thirty-seven years, for the quarter, by 3·6 inches.

Thunder-storms occurred, or thunder was heard and lightning seen, on 5th July, at Jersey, Guernsey, Truro, Torquay, Rose Hill, Oxford, Grantham, Nottingham, Hawarden, Gainsborough, Liverpool, Wakefield, Leeds, Stonyhurst, York, Durham, Newcastle, North Shields, and Dunino—much damage was done by this storm; on the 6th, at Jersey, Guernsey, Stone, Manchester, Stonyhurst, and Whitehaven; on the 11th, at Jersey and Guernsey; on the 12th, at Jersey; on the 13th, at St. John's Wood, Oxford, Hartwell, Hartwell Rectory, Aylesbury, Nottingham, Hawarden, Wakefield, Leeds, and Stonyhurst; on the 14th, at St. John's Wood, Rose Hill, Oxford, Stone, Hartwell Rectory, Linslade, Royston, Cardington, Bedford, Holkham, Nottingham, Hawarden, Gainsborough, Liverpool, Stonyhurst, and Glasgow; on the 15th, at Stone, Bedford, Norwich, Grantham, Holkham, Hawarden, Gainsborough, Stonyhurst, and Glasgow; on the 16th, at Jersey, Guernsey, Newport, Ryde, Southampton, Uckfield, St. John's Wood, Rose Hill, Oxford, Stone, Hartwell, Hartwell Rectory, Aylesbury, Linslade, Royston, Cardington, Bedford, Norwich, Holkham, Nottingham, Hawarden, Manchester, Stonyhurst, and Whitehaven; on the 17th, at St. John's Wood, Whitehaven, and Glasgow; on the 18th, at Ennis; on the 19th, at Ennis and Dunino; on the 20th, at Stonyhurst and Glasgow; on the 24th, at Ryde; on the 25th, at Greenwich, St. John's Wood, Hartwell, Cardington, and Bedford; on the 26th, at Grantham, Nottingham, and Hawarden; and on the 31st, at Hartwell Rectory, Aylesbury, Cardington, and Bedford. On 1st August, at Cardington; on the 3d, at Whitehaven; on the 4th, at Stone, Hartwell Rectory, Royston, Norwich, Liverpool, Whitehaven, and North Shields; on the 5th, at Guernsey, Newport, and Whitehaven; on the 6th, at Uckfield, Stone, Hartwell Rectory, Norwich, Gainsborough, Liverpool, Stonyhurst, Whitehaven, and Newcastle; on the 7th, at Hartwell Rectory, Nottingham, Gainsborough, and Liverpool; on the 8th, at Norwich and Nottingham; on the 9th, at Holkham, Nottingham, Hawarden, Liverpool, York, and North Shields; on the 10th, at Truro, Torquay, Uckfield, Stone, Hartwell, Hartwell Rectory, Aylesbury, Linslade, Cardington, Norwich, Grantham, Holkham, Nottingham, Liverpool, Whitehaven, Durham, Newcastle, and North Shields; on the 11th, at Ryde, Cardington, and Bedford; on the 12th, at Newport, Ryde, Ennis, Grantham, Liverpool, and York; on the 14th, at Liverpool, Wakefield, and Stonyhurst; on the 15th, at Ryde; on the 17th, at Jersey, Guernsey, Newport, Southampton, Uckfield, Greenwich, St. John's Wood, Rose Hill, Oxford, Stone, Hartwell Rectory, Aylesbury, Linslade, Royston, Cardington, Bedford, Holkham, Nottingham, Hawarden, Gainsborough, Liverpool, Wakefield, Stonyhurst, and York; on the 18th, at Jersey, Guernsey, St. John's Wood, Cardington, Bedford, Nottingham, and Gainsborough; on the 19th, at Torquay, Exeter, and York; on the 26th, at Jersey; and on the 30th, at Hawarden, Liverpool, and Durham. On the 4th September, at Holkham, Liverpool, and York; on the 5th, at Hartwell, Norwich, and Grantham; on the 6th, at Ryde, Midhurst, Rose Hill, Oxford, Stone, Hartwell, Hartwell Rectory, Aylesbury, Linslade, Cardington, Bedford, Norwich, Grantham, Nottingham, Wakefield, Newcastle, and North Shields; on the 7th, at Newport, Ryde, Uckfield, Greenwich, Midhurst, St. John's Wood, Oxford, Stone, Hartwell Rectory, Cardington, Bedford, Holkham, and Gainsborough; on the 8th, at Guernsey, Torquay, Newport, Ryde, Southampton, Uckfield, St. John's Wood, Stone, Hartwell Rectory, and Aylesbury; on the 9th, at Newport, Ryde, Uckfield, Midhurst, and Aylesbury; on the 10th, at Uckfield; on the 15th, at Falmouth; on the 20th, at Wakefield and Stonyhurst; on the 21st, at Holkham; and on the 28th, at Uckfield, Greenwich, and St. John's Wood.

Thunder was heard, but lightning was not seen, on the 3d July, at Hartwell Rectory; on the 4th, at Norwich; on the 5th, at Helston, Exeter, Hartwell, Royston, Grantham, Manchester, and Dunino; on the 6th, at Helston, Exeter, Stonyhurst, and North Shields; on the 7th, at Norwich, Durham, Newcastle, North Shields, and Dunino; on the 8th, at Guernsey; on the 9th, at Norwich; on the 10th, at Guernsey; on the 13th, at Jersey, Guernsey, and Stone; on the 14th, at Rose Hill, Stone, Hartwell, and Aylesbury; on the 15th, at Hartwell Rectory, Norwich, Gainsborough, Durham, and North Shields; on the 16th, at Greenwich, Grantham, and North Shields; on the 17th, at Bedford, Stonyhurst, and North Shields; on the 18th, at Royston, Cardington, and Hawarden; on the 19th, at Dunino; on the 24th, at Guernsey and Holkham; on the 25th, at Newport, Rose Hill, Oxford, Stone, Hartwell, Hartwell Rectory, Aylesbury, Linslade, and Royston; on the 26th, at St. John's Wood, Stone, Hartwell Rectory, Aylesbury, Grantham, and Stonyhurst; on the 28th, at Stonyhurst; on the 29th, at Bedford; on the 30th, at Dunino; and on the 31st, at Stone, Linslade, and Royston. On the 1st August, at Rose Hill and Linslade; on the 3d, at Jersey; on the 4th, at Jersey, Rose Hill, Oxford, Aylesbury, Cardington, Norwich, Hawarden, Durham, and Glasgow; on the 5th, at Jersey, Stone, Hartwell, Hartwell Rectory, Hawarden, Stonyhurst, Durham, and North Shields; on the 6th, at Jersey, Ryde, Greenwich, Rose Hill, Hartwell, Cardington, Nottingham, Hawarden, Durham, North Shields, and Glasgow; on the 7th, at Stone, Linslade, Cardington, Norwich, Leeds, Stonyhurst, and Dunino; on the 8th, at Royston, Norwich, and Grantham; on the 9th, at Greenwich, Rose Hill, Oxford, Stone, Linslade, Cardington, Grantham, Leeds, Durham, and Dunino; on the 10th, at Exeter, Southampton, Rose Hill, Oxford, Stone, Royston, Bedford, Norwich, Grantham, Gainsborough, and Dunino; on the 11th, at Royston and Stonyhurst; on the 12th, at Exeter, Cardington, Nottingham, Hawarden, and Whitehaven; on the 13th, at Cardington; on the 14th, at Greenwich, Grantham, Holkham, Nottingham, Durham, and North Shields; on the 15th, at Norwich; on the 17th, at Rose Hill, Stone, and Grantham; on the 18th, at Helston, Rose Hill, Stone, Hartwell, Bedford, and Grantham; on the 19th, at Helston, Falmouth, Royston, and Bedford; on the 24th, at St. John's Wood; on the 26th, at Guernsey; on the 28th, at Dunino; on the 30th, at Ennis, Stonyhurst, and Glasgow; and on the 31st, at Newport, Cardington, Grantham, and Nottingham. On the 4th September, at Newport and Linslade; on the 5th, at Stone, Hartwell Rectory, Aylesbury, Linslade, Cardington, and Nottingham; on the 6th, at Newport, Stone, Whitehaven, and Durham; on the 7th, at Ryde, Exeter, St. John's Wood, Rose Hill, Hartwell, Aylesbury, Norwich, Hawarden, Durham, and North Shields; on the 8th, at Helston, Ryde, Exeter, Hartwell, and Linslade; on the 9th, at Exeter, Rose Hill, and Stone; on the 10th, at Exeter; on the 11th, at Uckfield; on the 13th, at Helston; on the 15th, at Newport and Hartwell Rectory; on the 16th, at Rose Hill; on the 28th, at Aylesbury; and on the 29th, at Rose Hill.

Lightning was seen, but thunder was not heard, on the 3d and 4th July, at Hartwell Rectory; on the 5th, at Helston, Newport, Uckfield, St. John's Wood, Hartwell, and Manchester; on the 6th, at Oxford and Stone; on the 7th, at Stone; on the 9th, at Grantham; on the 11th, at Helston, Rose Hill, and Stone; on the 13th, at Newport, Uckfield, Greenwich, Rose Hill, Stone, Royston, Bedford, Nottingham, Liverpool, Stonyhurst. Whitehaven, Durham, and North Shields; on the 14th, at Southampton, Uckfield, Stone, Aylesbury, Norwich, Grantham, Whitehaven, Durham, and Dunino; on the 15th, at Oxford, Hawarden, and Dunino; on the 16th, at Greenwich, Royston, Norwich, Grantham, Hawarden, Gainsborough, and Liverpool; on the 17th, at Holkham; and on the 20th, at Nottingham. On the 4th August, at Uckfield; on the 5th, at Nottingham, Hawarden, and Durham; on the 6th, at Stone, Hawarden, and Durham; on the 9th, at Truro, Greenwich, and Grantham; on the 10th, at Southampton, Nottingham, and Hawarden; on the 11th, at Helston and Grantham; on the 13th, at Helston; on the 14th and 15th, at Grantham; on the 17th, at Falmouth, Southampton, Norwich, Grantham, and North Shields; on the 18th, at Helston, Oxford, Stone, Hartwell, Hartwell Rectory, Aylesbury, Linslade, Royston, Grantham, Hawarden, and Wakefield; on the 21st, at Aylesbury; on the 23d, at Guernsey; on the 24th, at Ryde; on the 26th, at Uckfield; and on the 30th, at Ryde. On the 4th September, at Southampton, Uckfield, St. John's Wood, Rose Hill, Oxford, Stone, Hartwell Rectory, Aylesbury, Linslade, Cardington, Norwich, Nottingham, Hawarden, Gainsborough, and Stonyhurst; on the 5th, at Rose Hill and Stone; on the 6th, at Guernsey, Southampton, Midhurst, and Stonyhurst; on the 7th, at Uckfield and Whitehaven; on the 8th, at Midhurst, Greenwich, Rose Hill, Oxford, and Nottingham; on the 9th, at Helston and Stone; on the 10th, at Greenwich, St. John's Wood, Oxford, Stone, Hartwell Rectory, Cardington, Norwich, Grantham, Nottingham, and Gainsborough; on the 15th, at Uckfield; on the 20th, at Hawarden and North Shields; and on the 28th, at Hartwell Rectory and Linslade.

Remarkable falls of rain, the 2d July, at Stonyhurst was 0·5 inch; the 5th, at Grantham 1·6 fell in about 1 hour, at Gainsborough 0·5 in 1 hour, at Leeds 0·6, at Durham 2·3, and at North Shields 2·6 fell in 5½ hours; the 6th, at Guernsey 0·8, at Derby 1·7; the 12th, at Guernsey 1·7; the 13th, at Stone 0·5, at Wakefield 1·9, at Leeds 0·5; on the 12th and 13th, at York 0·9; the 14th, at Hartwell Rectory 0·6, at Linslade 0·8 fell in a few hours, at Royston 1·4; the 15th, at Derby 0·9; the 16th, at Guernsey 0·5, at Ryde 1·0, of which 0·8 fell in 20 minutes, at Enfield 0·6, at Royston 1·0; the 17th, at Newport 0·7, at Hartwell Rectory 0·6, at Aylesbury 1·4, at Whitehaven 1·3, which fell in about 1 hour; the 25th, at Ryde 1·5, at Greenwich 2·0, of which 1·0 fell within 15 minutes, and 0·5 fell in a quarter of an hour at another time in the day, at Rose Hill, near Oxford, 1·4, at Royston 0·7; the 26th, at Newport 0·9, at Southampton 1·6, at Enfield 0·6, at Grantham 1·2, at Derby 1·4, at Nottingham 2·1, at Gainsborough 0·6, at Manchester 1·0, at Wakefield 0·5, at Stonyhurst 1·0, and at Durham 0·7. On 2d August, at Falmouth 0·6; the 7th, at Ryde 0·6, at Derby 1·0; the 10th, at Falmouth 1·2 during the preceding night, at Southampton 0·7, at Stone 0·7, at Hartwell Rectory 0·6, at Linslade 0·6, at Grantham 0·5, of which 0·3 fell in 10 minutes, at Stonyhurst 0·9, at Durham 0·7; the 11th, at Falmouth 0·7, at Torquay 1·7, at Ryde 1·0, at Stone 0·8, at Hartwell Rectory 0·9, at Linslade 0·9, at Royston 0·5, at Cardington 1·0, at Bedford 0·9, at Grantham 0·9, at Notting-

ham 1·1, at Gainsborough 0·8, at Wakefield 0·8, at Leeds 0·6, at North Shields 3·1 fell in 19½ hours; the 12th, at Torquay 0·8, at Ryde 0·6, at Southampton 0·9, at Greenwich 0·6, at Enfield 0·8, at Linslade 0·6, at Grantham 0·8, at Derby 0·7, at Stonyhurst 0·5, at Durham 1·0; the 13th, at Newport 0·6, at Ryde 0·7, at Norwich 0·6, at Durham 0·7; the 14th, at Falmouth 0·7, at Southampton 1·7, which fell in 5 hours, at Stone 0·7, at Hartwell Rectory 0·7, at Royston 0·9, at Cardington 1·3, at Bedford 1·2; the 15th, at Guernsey 0·8, at Torquay 0·5, at Newport 0·7, at Ryde 0·8, at Greenwich 1·1, at St. John's Wood 0·6, at Linslade 0·9 in 7 hours, at Derby, 0·6; the 16th, at Uckfield 1·2; the 17th, at Southampton 0·8, at Stone 1·6, at Hartwell Rectory 1·4 in 5 hours, at Linslade 1·2, of which 0·9 fell in 1 hour, at Bedford 1·2, at Grantham 1·2, of which 0·8 fell in 40 minutes, at Hawarden 1·7, which fell in about an hour, at Gainsborough 1·0, at Stonyhurst 0·6; the 18th, at Enfield 0·5, at Stone 0·6, which fell in 1 hour; the 19th, at Ryde 0·6, at Norwich 0·8, at Grantham 0·6; the 20th, at Ryde 0·7; the 24th, at North Shields 1·5; the 25th, at Stonyhurst 0·8; the 29th, at Enfield 0·5; the 31st, at Stonyhurst 0·7—these heavy falls did much damage to the crops. On 5th September, at Norwich 0·5, at Grantham 0·5 fell in about a quarter of an hour; the 6th, at Linslade 0·7 fell in 2 hours, at Grantham 1·0, at Nottingham 2·6 fell in 28 hours; the 7th, at Manchester 0·5, at Durham 0·5; the 8th, at Southampton 0·7, at Uckfield 0·9, at Greenwich 1·0, at Enfield 0·6, at Hartwell Rectory 0·6, at Aylesbury 0·8 fell in about 1 hour; the 9th, at Newport 1·4, at Ryde 0·6; the 10th, at Newport 0·6, at Ryde 0·7, at Southampton 0·7 fell in 1 hour, at Uckfield 1·2; the 15th, at Grantham 0·5; the 16th, at Norwich 1·4; the 18th, at Torquay 0·7, at Greenwich 0·8, at Stone 0·7, at Linslade 1·0, at Grantham 0·6, at Hawarden 1·3, at Wakefield 1·2, at Leeds 0·9, at Stonyhurst 1·0; the 19th, at Newport 0·8, at Ryde 0·8, at Southampton 1·0, at Hartwell Rectory 0·7, at Royston 0·6, at Stonyhurst 0·6; the 20th, at Norwich 0·6, at Hawarden 0·8, at Stonyhurst 0·5; the 26th, at North Shields 0·7; the 27th, at Enfield 0·7, at Norwich 1·1, at Durham 0·5, at North Shields 0·9; the 28th, at Newport 0·7, at Ryde 0·6, at Southampton 0·7, at Uckfield 1·0, at Greenwich 0·9, at St. John's Wood 1·0, at Hartwell Rectory 0·5, at Norwich 0·7, at Leeds 1·0, at Durham 0·6, at North Shields 3·9; the 29th, at Falmouth 1·4 fell during the afternoon hours, at Torquay 1·1, at Grantham 1·0, at Nottingham 1·0, at Wakefield 1·0, at York 1·3, at Durham 2·5, at North Shields 0·9; the 30th, at Torquay 1·3, and at Durham 0·6—thus, at North Shields, the amount of rain, from September 26 to September 29, was 6·4 inches.

Evaporation of water from a surface of water, amounted to 10½ inches within the quarter.

Solar Halos were seen on 6 days in July, on 8 days in August, and on 15 days in September, at the different stations.

Lunar Halos were seen on 6 days only at the different stations during the quarter.

Hail fell at a few places on 5 days in July, on 7 days in August, and on the 30th September at Liverpool.

Snow fell on Ben Nevis and the highest Grampians, on the 20th September.

Fog, with the exception of places situated within the latitudes of 51° and 52°, was inconsiderable; between these parallels, it occurred on 7 days in July, and on 12 in September.

Aurora Borealis occurred on the 3d, 6th, 13th, and 14th of July, and on the 11th, 17th, 18th, 19th, 20th, and 21st of September.

Ice.—At Hawarden, on 10th August, large angular pieces of ice fell during a thunder-storm.

Wheat began to be gathered, at most places between the latitudes of 49½° and 53°, on the 1st, 2d, and 3d of August; at Durham on the 16th, North Shields on the 17th, and Dunino on the 24th.

Harvest was completed, at places south of latitude 55°, between the 17th and 27th of September, but was not completed by the end of the quarter north of this parallel.

Calendar of Nature for the Quarter, as observed by E. J. Lowe, Esq., M.B.M.S., near the centre of England.

July	7.	Roses in full glory; Portugal laurel in full flower.
—	10.	Strawberries very abundant; cherries ripe; red currants ripe.
—	11.	Much hay safely housed.
—	13.	Myosotis pelustris in flower.
—	16.	Lime-trees in full flower.
Aug.	3.	Some corn cut.
—	12.	Many wasps.
—	20.	Much corn cut.
Sept.	1.	Peaches and nectarines plentiful; jargonel pears ripe.
—	6.	Potato disease prevalent; many wasps and caterpillars.
—	20.	Dawson plums ripe; nuts ripe.
—	24.	Very many lady-birds to-day.
—	29.	Limose Arborum very plentiful.

RECENT PATENTS.

FINISHING WOVEN FABRICS.

JOHN CAMPBELL, *Bleacher, Bowfield, Glasgow.—Enrolled Nov.* 10, 1852.

Mr. Campbell's invention comprehends, first, an arrangement for working the warp and weft threads of woven fabrics angularly over each other, for the production of the "elastic finish;" second, two modifications of breadtheners, for securing the full width of the goods; and third, a steaming and gradual cooling process, for improving the appearance of woven fabrics. The elastic finishing machine is essentially dependent for its action upon the combined effect of a series of pairs of opposed or reverse cone rollers, over or between which the fabric is made to pass. The piece passes into one end of a long machine, by running over a revolving breadthener, where it receives its first widening stretch. It then passes beneath a pair of rollers grooved circumferentially—the two rollers being fitted together, so that the projections on one shall fit into the recesses on the other; and the piece, in passing through, is thus breadthened, by the action of the projections on one roller pressing it down into the grooves on the other. Thence the piece passes over a second revolving breadthener, like the first, and then enters the first pair of angling cones. These cones revolve on horizontal axes in reverse directions, and the cone surfaces are also reversed in each pair; that is, the large end of one cone is opposed to the small end of its neighbour, and so on. Then, as the piece reaches the first cone, or reaches the line of primary contact, the threads are angled in one direction, owing to the effect of each increment of the increasing circumference cone—from the smallest to the largest end—in drawing forward the piece at a quicker rate than any minor length of circumference; or, in other words, from the constant drawing forward of that side of the piece next the largest end of the cone; this necessarily angles the piece forward on that side—the opposite side being held back by the more sluggish rate of movement of the smallest circumference. In this singly angled state, the piece passes to the second or reverse cone, so that the forward angled side, from the largest end of the first cone, now runs over the smallest end of the second cone; and hence arises the reverse draught forward, or opposite angling action. This completes the angling effect, the result being in reality similar to that of the old system of reverse "thumbing," or hand-finishing. The cones are reduplicated throughout the machine to a greater or less extent, as may be required, breadtheners being interspersed with the cones to keep up the width.

The revolving breadtheners are composed of a series of laths, carried on ground discs, running on a fixed shaft, the required longitudinal traverse of the bars being effected by the action of a pair of fixed inclined discs, the peripheries of which are embraced by pairs of small pulleys on the inner surface of each bar. Another form of breadtheners consists of two pairs of parallel endless belts, of transverse laths, which work together, one above the other, like an upper and lower endless feed-cloth. Each belt expands towards its delivery end; and as the laths on one fit into the spaces on the other, the piece, in being carried through between the two, is breadthened by the combined forward and lateral traverse of the laths, each lath being secured only at one end, whilst the other has liberty to move in a longitudinal slot.

According to the last head of the invention, Mr. Campbell treats cotton goods by steaming them in a close chamber, fitted with a sparred bottom, the steaming action being kept up for a greater or less period, according to the nature of the goods, or the intended style of finish. After this treatment, the goods are removed, and gradually cooled in a well-ventilated room. By this treatment the threads are swelled, and the cloth has a full, substantial appearance imparted to it. Of the several plans embodied in this patent, we especially admire the elegant simplicity and efficient action of the conical rollers in producing the elastic finish. No existing finisher at all approaches this arrangement in point of cheapness and ease of working, whilst the angling action seems to be exactly what is wanted.

BOTTLES, JARS, AND STOPPERS.

F. J. BELTZUNG, *Engineer, Paris.—Enrolled October* 15, 1852.

M. Beltzung's invention consists in forming bottles and jars with caps or stoppers to screw on, instead of the common system of closing. The bottle is taken whilst the glass is still plastic, and its neck is inserted between a pair of dies, a hollow expanding mandril being passed into the neck as a support from within. The dies are brought together by a treadle action, whilst the internal mandril is made to revolve and expand simultaneously. This effects the double purpose of smoothing the interior of the neck, and pressing its exterior surface into the dies, which are screw-threaded, and produce a perfect screw round the neck. The patentee also specifies the employment of a solid mandril for this shaping action, and a mode of giving such mandrils the power of expansion, by making them conical, and passing them to a greater or less distance into the neck. Bottle caps, or stoppers, and jars may also be moulded with devices or screw-threads upon them, by an apparatus like a bullet-mould. When in use, such a mould is first shut up, and is then brought under a descending plunger, which is capable of passing into the interior of the mould. A piece of plastic glass is then dropped into the mould, and the

plunger descends to squeeze the glass into all parts of the mould, and at the same time shape the cavity of the jar.

By another process, the caps are made from flat metal discs, which are pressed into and through a die, by means of a descending mandril, so as to "draw" the disc into a cup shape. This cup is then fitted on to a screwed mandril, and the sides are forced into the hollows of the screw-threads by pressure in the lathe. Another head of the improvements relates to a plan of cap for aerated water bottles. The stopper, in this instance, consists of a screw-cap, through which a gutta-percha tube is passed; an india-rubber valve being fitted at the bottom of the tube, the egress of the liquid is prevented, until the tube is pressed inwards by the thumb, so as to open the valve.

MANUFACTURING AND FINISHING.

David Dick, *Machinist, Paisley.—Enrolled November* 22, 1852.

The first head of Mr. Dick's invention relates to two separate modifications of Jacquard weaving apparatus, together with a new arrangement of punching apparatus for perforating Jacquard pattern cards. The second portion consists of a mode of twisting or finishing shawl fringes.

Mr. Dick first describes his improvement on the Jacquard, in its application to apparatus with vertical draught needles, the special object being the securing what we may term "a duplex shed action" of the warp in the loom, by the combined effect of those pattern needles which are in action, with the others which are out of action at any given stage of the figure. In other terms, the patentee obtains a full-wide shed opening, with a short traverse of the parts concerned in the production of the shed. This important result he brings about by giving to the lower platform—on which the lower ends of the needles rest, and which is usually a fixture—an amount of reverse vertical traverse equal to that of the upper frame or platform, which traverses at each needle action. Thus, as the upper platform rises, carrying up the hooked ends of those needles whose horizontal pattern needles have met with pattern holes, and thus shedding the warp threads in connection with these needles to one side, the corresponding descent of the lower platform permits all those needles that have not met with pattern holes to descend a similar distance, to draw *their* set of warp threads to the reverse side. Thus each set of needles are caused, by their joint endeavours, to produce the required shed, with only half the traverse ordinarily requisite. Mr. Dick also details this system as applied to Jacquards, vertical and horizontal needles combined; the result being the same as in the first example. He also shows some important improvements in the actuation of the pattern barrel, and a mode of causing the vertical needles to work without the aid of the usual springs, by forming a heel-piece on each needle, so that the draught on the hook constantly tends to bring forward the upper end of the needle in the intended direction.

The punching machine is fitted with a double row of punches, set in a cross beam, actuated by a treadle, each punch being brought into play, as required, by a finger action upon a set of horizontal engaging pins, which hold or release the individual punches at pleasure. The pattern-sheet or web is wound upon a pair of rollers beneath, and whilst it is periodically traversed forward longitudinally, to bring a fresh blank beneath the punches, the punching table, with the fabric, is traversed transversely, to punch a double row of holes across the piece.

The shawl-fringe twisting machine is contrived for twisting the whole length of fringe on a shawl at once, by means of a pair of long parallel twisting "fingers" of india-rubber, working in concert with a pair of "dividers," or opposed separating teeth, like combs. Both the fingers have an oscillatory movement upon longitudinal axes, and the fringe being stretched vertically between the dividers when turned up out of gear, the dividers are then turned down, to cause their opposed teeth to penetrate into and separate the threads. In this state the primary twist is given by a reverse longitudinal traverse of the pair of fingers; and then one of the dividers being taken out of gearing laterally, the opposite one is pushed further into gear, so as to cause each of its individual spaces to take in a pair of the twisted strands. The secondary or "back twist" is now given, by the return traverse of the fingers, thus causing each pair of primarily twisted fringe threads to become entwined together.

The whole of these improvements present many features of practical ingenuity, which our short notes but feebly illustrate.

HYDRAULIC SYPHON.

F. C. Mouatis, *Earlstown, Berwick.—Enrolled June* 30, 1852.

This is what the patentee considers to be a new and improved apparatus for raising water. Its chief peculiarities consist in the bore of the cylinder being no greater than that of the pipe, and in the valves being formed by a series of rings, set one over the other in a conical pile, so as to work without appreciable friction—like Hosking's valves, for example.* In other respects, the apparatus is similar to a common force pump; the patentee, however, is persuaded that it involves some valuable principle hitherto unknown. He conceives that little or no power is needed to work his "inverted syphon"—that, for instance, the power developed by a *part* of the water raised, is sufficient to actuate the piston by the intervention of a water-wheel.

Amongst other applications of his invention, the patentee proposes to double the speed of steam-boats, by arranging syphons to raise water to act on the paddle-wheels as on ordinary water-wheels, the syphons being worked by the engine, but without requiring any extra power! We are afraid that we have already said enough to show, to the satisfaction at least of the readers of the *Practical Mechanic's Journal*, that Mr. Mouatis has unfortunately fallen into a grave error. The most unpleasant duty devolving upon a journalist is that of giving judgment adverse to the hopes of an ardent inventor—of telling him, indeed, that his long-cherished and highly-elaborated plans—the result, perhaps, of some patient but ill-directed thought—are mere idle day-dreams. Yet such, we are painfully compelled to say, is the case between us and Mr. Mouatis.

REVIEWS OF NEW BOOKS.

Agricultural Products and Implements. By John Wilson, Esq., F.R.S.E., F.G.S. Bogue, London. 1852.

This discourse forms the first of the second series on the results of the Great Exhibition; and the name of the author is a sufficient guarantee that it comprises all the learning that can be brought to bear upon the subject. It is out of our province to enter at large into the first portion of this paper, but there is much to interest our readers in the latter part. Mr. Wilson fully discusses the merits of the various machines constructed to serve the progressing agriculturist. We must let him speak for himself as regards the universally-adopted threshing-machine:—

"In another machine, termed the 'threshing-machine,' in very general use throughout all well-farmed districts, any errors in construction are very sensibly felt. For many years they have been made by makers whose names seemed to satisfy the public that they were of the best description, and as they got through the work for which they were intended, no notice was taken as to how it was performed, until, at the Norwich meeting in 1849, when it occurred to the consulting engineer that the draft of the machine itself should be tested when empty, before its power was tested in operation. This trial demonstrated at once their imperfect construction. It showed that some of the best four-horse machines required no less than three horses to set them in motion; in other words, that, out of the four horses, three were employed in moving the various parts of the machine itself, and only one was engaged in threshing out the corn, thus only possessing an effective power of 25 per cent. So little, too, had the makers attended to principles in construction, that this enormous waste of power was capriciously divided between the horse works and the barn works. Two machines that were tested furnish an excellent illustration of this point. In these the whole amount of friction was nearly identical, being 278 and 281. But it was distributed in quite an opposite manner: the respective horse works consuming 207 in the one, and only 46 in the other; while the barn works of the one consumed only 71, while the other consumed 235. Thus these two makers were working so irrespective of principles, that if the two best of the correlative parts had been put together, one horse of the four could have overcome the resistance, and a duty of 75 per cent. been obtained; while, if the two worst had been selected to work together, the resistance they would jointly have offered would have been equal to the power of 4·5 horses; and thus the four-horse power applied would not even have set the machine in motion. This trial produced good effects. In the Exhibition last year were machines by the same makers, in which these remarkable errors no longer existed; and although very great differences existed in the several parts of the operation, as performed by the trial machines, still, estimating them as a whole, they were very satisfactory, exhibiting a difference of not more than 25 per cent.

One of the most curious facts is noticed by Mr. Wilson, and may serve to add considerably to the just pride of the purely practical mechanic. Machines are made for innumerable purposes; but it was reserved to these times to create them for the purpose of aiding the mastication and digestion of their food by sheep and cattle. "The farmer, acting upon those physiological principles so beautifully and clearly demonstrated by Liebig and others, has found it to his interest to employ machinery to effect that mechanical division of the food, which otherwise would have to be done by the stock themselves at a much greater cost and risk." The successful application of a scientific principle, says the author, in this, the first part of the process of feeding, has contributed very much towards the attempt to carry it farther, by steaming or cooking the food.

We commend to our readers especially to notice the significant terms in which Mr. Pusey concludes the report of the jury in that department of the Great Exhibition to which this discourse refers. Mr. Pusey gives the following most important deductions:—

1. That the application of machinery to the main branches of farming labour, taken together, has effected a saving on outgoings, or an increase on incomings, of not less than one-half.

* See Pp. 154, 184, Vol. IV., *Practical Mechanic's Journal*.

2. That new agricultural machines have, with reference to the amount of saving produced by them, the merit of very great cheapness.

3. That machinery has given to farming what it most wanted, not absolute, indeed, but comparative certainty.

The immense field, literally speaking, which is thus offered for the labour of the mechanic, and to which his powers may emigrate, is what must not, cannot now be disregarded. Let him not wait for the demand to originate the supply; but let him rather put his thought to the wheel, and devise and construct further implements, which the agriculturist will not be able to do without. There is nothing effective yet done with regard to a steam spade to displace the plough. Honour and fortune await that individual who shall successfully bring into practice a machine of this kind.

The qualified terms in which Mr. Wilson speaks of the Americans, as regards their reaping-machine, is perhaps the best criticism, among the many, that have been made upon them. He says that, although he offers evidence against the award of undeserved praise to them for their machine as an invention, he wishes to acknowledge the deep debt which he believes agriculture owes them for having been the means of calling public attention to the subject at such an opportune time. We all remember the excitement which took place during the harvest of 1851 with these machines—"how they were followed from place to place throughout the country, and how their merits were discussed by their different admirers." It is very strange, and passes no little slur upon the agricultural mind, that such machines, although they have existed for fifty years, and been in actual use for twenty years, should not at present be more generally known. Perhaps the mode of construction being fragile, and soon liable, without constant attention, to get out of order, may, in some measure, account for this; but our agricultural mechanics should look about them.

The great advantages resulting from crossing the different breeds of animals is familiar to the agriculturist, but this knowledge was confined to animals. It is singular how knowledge grows, and how long it is before the generality of men venture to generalize, or, in other words, to extract from simple fact a principle. "In the hybrid wheats exhibited by Mr. Maund and Mr. Raynbird, an important step in the application of scientific knowledge to agriculture has been attained." By thus launching out beyond the path of practice, these gentlemen have done the great service of pointing out new paths of certain improvement in *this* species of the *cerealia*.

Mr. Wilson advocates means to secure to "that least-cared-for and worse-lodged animal on the farm—the poor labourer"—the advantages which would accrue to him by being housed according to the models erected in Hyde Park at the expense of his Royal Highness Prince Albert, and with considerable force. And we trust the quiet suggestions thrown out will not be unattended to.

The lecturer concludes his carefully-digested essay, by giving his opinion that, in *general agriculture*, this country offers, *at present*, the first place; and speaking as for the intelligent farmers of the British islands, he says, "we will never rest satisfied until we have secured for agriculture the position which she ought to have as a scientific manufacture, and as the most important and vital of all our industrial resources."

Prize Essay on the Farming of Northamptonshire. By William Bearn, Land-Agent and Valuer. Pp. 70. Hamilton, Adams, & Co., London.

It is the characteristic feature of mechanical philosophy to be universal in its applications; and when we speak of mechanical philosophy, we always include practical mechanics as the substratum upon which such philosophy can alone be rightly founded. While, however, physics are more immediately and constantly benefited by its many ingenious instruments, we know that even moral subjects are capable of being rendered more teachable by analogies, which may readily be presented to the eye by the proper machine. Hence it is that we notice this work, which is evidently the careful labour of many observant years, and shows precisely that form of conveying information the best adapted for those who both require and need it. It is a reprint from the pages of the Journal of the Royal Agricultural Society, and comprises the Essay on the Farming of Northamptonshire, to which the prize of £50 was awarded by the Society in the year 1851. It presents, as was desirable to be seen, an outline of the system of husbandry generally presented throughout the country, and is a full, fair, and impartial report upon the practical farming of Northamptonshire, enriched with a very accurate map, exhibiting, by different tints, the different surface soils.

The author plainly admits that the farmers of Northamptonshire (which is one of the strongholds of the agriculturist) have not reached in their pursuits that degree of perfection which is visible elsewhere, and acknowledges that they are but learners in the science. The law of progress, he says, has not even reached the broad acres of his county's cold wet pasture-land. Upon this point he has some very excellent remarks upon draining, illustrated by diagrams; but want of space compels us to omit what we should otherwise have been glad to convey to our columns. One fact, however, must not pass unnoticed:—

"John Smith, Esq. of Thornby Grange, has erected some new farm buildings, the site of which previously was a complete bog. He commenced by drainage, and succeeded in cutting off the supply of water, which he now applies, by the aid of a water-wheel, to the purposes of threshing his corn and cutting chaff with considerable success."

Mr. B. very justly remarks, that "it is not by parchment covenants that the landlords will insure the highest culture of the soil;" and he then goes on to detail the only real method of proceeding. "To sow land out of condition is always a losing game, and a more generous and liberal mode of cultivation is the most profitable to the occupier, and more beneficial to the community." This forms a text which is throughout enlarged upon.

He mentions many facts, showing what may be done on inferior land by steady perseverance and skill, and by which agriculturists may be enabled to effect "such a form of progress as the boy bounding from ant-hill to ant-hill after the peewits," to the temperate and industrious author of the present essay, who, from the field where the birds were plentiful, and which he recollects as "very poor grass land, he has lately (thanks to Mr. Joseph Elkins, a tenant of Earl Spencer's) seen carted a very splendid crop of oats." He goes on to say:—

"The man who now expects to succeed in the cultivation of the soil, and to maintain his position in the struggle of life, which is becoming daily more severe, must lay aside the prejudices and preconceived opinions of his forefathers, and adopt the onward progress of an improved husbandry."

The author shows many advantages resulting from the application of mechanics to his subject, and, amongst other instances, he relates one which he must tell himself:—

"I once lost considerably by being just one day too late in drilling a field of barley: wet weather set in, and that part of the field that was drilled in early, on a dry tillage, was more productive by two quarters per acre than the remainder of the field, which was deferred for two or three weeks, in consequence of the weather being unfavourable. It taught me a lesson, and the next year I purchased a Suffolk drill."

Upon the subject more immediately claiming our own attention, he enlarges as follows:—

"It would be a fruitless attempt to endeavour to condense into this report a tithe of the improvements that have been effected by mechanical skill in the manufacture of agricultural implements during the last forty-five years; I shall, therefore, only refer to a few, commencing with the plough. I have myself held many times, in the once open fields of Stanwick, one of those odd-fashioned one-handled ploughs, the right handle not being fixed, but consisting of a staff with a hook at the end of it, supplying at once the double office of handle and plough spade. This was abolished for the Woodford swing-plough, 'which still is a useful implement for the stirring of rough fallows;' after which Ransome's and other wheel ploughs were introduced. I remember when Mr. Turnell, of Dallington, who at that time was occupying a large farm at Stanwick, introduced the wheel plough on his farm, that it produced quite a consternation among the ploughmen and boys; loud and frequent were the prophecies that they would never do, but they have outlived all their predictions, and we have now at our different annual ploughing matches as good specimens of ploughing as can be done in any of the adjoining counties.

"The threshing and winnowing machines are both new inventions; the former has, to some extent, displaced the flail, and the latter the fan. Crosskill's clod-crushers have superseded the 'wooden beetle,' or spiked roll; the drill takes the place of the seblet; and in every kind of agricultural implements, the mechanical skill of the different makers has been called into active enterprise. * * * * *

"Many of the modern implements seem to have called forth the ingenuity of the makers, but are not always adapted to put into the untutored hands of the agricultural labourer; and many a farmer has the mortification of seeing a very nice piece of machinery broken or rendered useless by the neglect, inattention, or want of skill of his servant. Strength and durability are not always sufficiently taken into consideration with many implements for daily use in the cultivation of the soil."

"The want of suitable machinery to convert the fibre into flax," we are told, occasioned the almost total abandonment of the growth, which had formerly been promoted by the Rev. Sir George Robinson, Bart., of linseed for cattle. Our farmers are beginning to find it not unadvantageous to grow other things besides turnips, and we are glad to be told that this growth of flax is still persevered in by Mr. Wallis of Rowell Lodge, who, in connection with other proprietors, has also commenced the growth of chicory. These deviations from the beaten path are very highly commendable, as they exhibit proofs of more than ordinary acquaintance with those general laws of progress, the silent working of which has given us our present hopes.

We cordially agree with Mr. Bearn, that "the art of husbandry is every day becoming more a science, employing more mechanical skill, and requiring a greater amount of knowledge, in order to develop the resources of the soil."

We believe the author is the eldest son of Mr. Bearn of Wellingborough, the reputation of whose practical philanthropy has extended largely around the centre of its immediate usefulness; and we have been gratified in observing, when incidentally noticing the condition and wants of the agricultural labourer, that the author has not forgotten the teachings which he received in early life.

A New General Theory of the Teeth of Wheels. By Edward Sang, Professor of Mechanical Philosophy in the Imperial School, Muhendis-Hana Berrii, at Constantinople. Pp. 97. 53 Plates. Edinburgh: Adam & Charles Black. 1851.

"In the year 1837, a short paper, containing the general principle of investigation followed in the present work, was read before the Royal Scottish Society of Arts," and this paper the author has since expanded into the volume before us. We cannot give a better idea of the contents, than by further quoting from the introduction:—

"The method of research therein explained, collecting under one point of view all that was previously known of the theory of toothed wheels, has brought to light important general principles, and has guided the application of these to the solution of problems which, before, could hardly have been entered upon. Under these circumstances, the author takes some blame to himself for having so long postponed the publication of a theory which, in other hands, might, by this time, have received a much greater development. He has endeavoured to atone for the unwilling delay, by increased care in the elucidation of the subject; and his regret has been somewhat lessened by the fact, that, having frequently recast the essay for the last time, he has been obliged, by the accession of new ideas, to recast it once more.

The theory of toothed wheels, involving, from its very nature, the doctrines of contact and of variations, necessarily belongs to the higher department of the mathematics, and requires the assistance of the fluxional calculus. On this account, it is impossible to render all our investigations intelligible to those who have proceeded no farther in their studies than to elementary algebra and geometry; yet, wherever it was found possible, the aid of the higher calculus has been dispensed with, and the results have been enunciated in such a way as to be intelligible to the great bulk of students of engineering. May the perusal incite to renewed exertion, those who still hesitate at the threshold of the differential and integral calculus!

"The study of the proper form for the teeth of wheels, is forced upon us by the frequent occurrence of wheel-work in machinery. In the earlier machines it was considered enough that one tooth had not ceased its action until another tooth had become engaged; but by degrees, as wheel-work came to be applied to more and more delicate purposes, a relative uniform motion of the two axes came to be desirable. Römer, the celebrated Danish astronomer, proposed, in the year 1674, the *epicycloid* as the proper form for the tooth. Since that time, the epicycloid, and its obvious extension, the involute of the circle, have been regarded as the true forms for the teeth of wheels; yet, although these curves satisfy, geometrically, the condition of contact, they are very far indeed from satisfying the wants of the machine maker.

"Besides the form of the tooth, other topics have been discussed. The amount of friction has, perhaps for the first time, been rigorously examined, and the statical and phoronomic effects of malformation have been pointed out. The concluding article, on the computation of trains of wheels, will prove, it is hoped, a valuable aid to those engaged in the laborious process of constructing orreries: for the greater part of it, the author believes that he can claim the merit of originality."

If a couple of discs, with their pitch circles touching, be made to revolve at a rate proportionate to the required number of teeth in each, a point may be imagined as travelling along a curve returning upon itself, in such a manner that it will describe the forms of the respective teeth on each disc. It is to ascertain the best curve for this tracing point, that Professor Sang's investigations are directed, and he fixes on a curve which he denominates the hour-glass curve, "familiar to engineers as that described by the attachment of the piston-rod in Watt's parallel motion, and which is also exhibited by the vibration of a straight wire, whose breadth is double of its thickness." He has been at very great labour to compute tables of co-ordinates for all the varieties of this curve that may be required, whereby wheels may be constructed on the principles set forth.

This is a work of very great talent, even if we do not consider the immense labour absorbed by the calculations which fill the volume; but we are afraid the author has gone somewhat too deep into the matter, and that the work is too abstruse for general mechanical and practical purposes. Indeed, we question if the system is likely to be adopted, unless it be in the highest class of astronomical instruments.

Plan for Preventing Railway Trains from Running Off the Rails, and for Stopping them Instantaneously. By J. P. Wachter, Jun., C.E. Plates. Pp. 14. Rotterdam: H. A. Kramers. 1852.

This is a remarkably well-got-up pamphlet, explanatory of two separate contrivances in mechanism—the prevention of deviation from the rails, and the instantaneous stoppage of railway trains, both arrangements being capable of combination in one system. The author proposes to employ, in the first place, a middle rail, to be embraced loosely by guides attached to the framing of the carriages; and secondly, a system of brakes, actuated by rods and levers, so arranged that the brakes of each carriage composing the train can be brought to bear by the turning of a screw on the engine or tender. Should the two plans be combined, the mechanism which actuates the brakes may also be constructed to thrust down the guides upon the central rail, in such a manner, however, as to exert a pressure somewhat less than that of the brakes on the peripheries of the wheels.

M. Wachter shows much ingenuity and judgment in carrying out his plans, but there is little or no novelty in their general features. The introduction of a third or middle rail is an expedient proposed almost as long ago as the railway itself, but the other arrangements are of more modern date.

M. Wachter does not lose sight of one great objection to his plan—namely, the cost of the additional rail; but he considers that it will be difficult to find any means of insuring safety without extra expense, and that the matter is, consequently, resolved into a question of the value of human life.

It seems to us of little use to improve the mechanism of railway conveyance, at any rate in a manner involving such expense. It is not to defective apparatus that we must attribute what few railway accidents occur now-a-days. It is in the management of the traffic that improvement is wanted, and, until this takes place—that is, so long as carelessness and inattention continue to be the characteristics of railway guards, brakesmen, &c.,—we may look for accidents, whatever mechanical would-be preventives, wire-drawn ingenuity may interpose.

A Letter to the Congestive Bankerhood of Great Britain, with a Proposition for a New Currency. By a Traveller (not from Geneva). Pp. 20. London: Effingham Wilson. 1847.

The speculative ingenuity of mankind has never yet been exercised in devising a "new thing," but some impertinent scribbler picks and pries into the past, and in some wholly neglected page starts the same idea. We are almost compelled to conclude, from such frequent occurrences, that because honour is due to *all* men, it is not properly attributable to some few only. And the world acquiesces in the laborious curiosity displayed by the man of research, as he tumbles over his dusty volumes, and, partaking possibly of some envious feeling, is glad to see rescued from oblivion any ancient literary production containing a thought or two, if it be but somewhat akin to the winged thoughts of our own days. This general sentiment must form our excuse for noticing at the present time this pamphlet, first published so long ago.

It is unquestionable that the recent discoveries of gold in the new and old worlds are, whether or not anticipation as to their extent be realised, beginning to work some revolution in the thoughts of those who have hitherto clung to notions not their own as supports of principles, the truth of which they have taken for granted. The author of the above few pages appears to have been very early influenced by prospects which his ingenuity had conceived, before as yet the discoveries alluded to in California and Australia were made—for the publication of this letter preceded by some weeks the first discovery of the precious metal in north-western America.

Smart and racy, the manufacturer speaks out with all his voice to Mr. Zamiel Groans Loud, the money-dealer, whose little follies and foibles are unsparingly lashed.

The banker very properly calls those persons who deal with him his customers, and this little name lets in a great and significant truth. A banker is but a tradesman in a certain commodity—money—be it in the form of solid gold, bank-notes, or bills of exchange, or, in the words of the commercial slang of these pages, blunt, flimsy, or stiff. All dealings in the world of commerce depend upon credit in some one or more of its forms; and credit itself might, if we were to write an essay upon the subject, be assumed as the only real standard of value. The great mistake in the money-dealer has been to suppose that he could fix some physical standard. "I believe in gold," is his creed. The fluctuating value of that which he thus believes in—the mere possibility of its fluctuating value to the extent to which the gold discoveries may lead—is, however, beginning to stagger his belief, and the author would point him a remedy in a proposition for a new currency. Far between are such propositions in "this water-walled workshop of the world" of ours; and every one who, as we believe, thinks correctly, when he would push free trade into all quarters, has a right to be heard—let his sayings pass for what they may. We, therefore, permit our present author to speak for himself:—

"And now, good Mr. Groans, we will propose to you a new currency, founded on real property. If a man has an hundred acres of land, worth, say £5,000, and wants capital to farm it, he borrows money on mortgage; but the expenses are so heavy that it is a serious drawback to enterprise. Why should he not go to a state bank, and, depositing his title-deeds therein, draw forth notes to the amount of two-thirds of the estimated value of the land, the estate being chargeable with interest till the notes were redeemed? Why should not a man with a valuable dwelling do the same thing, getting only one-half the value? Why should not a manufacturer do the same thing with his factory? 'Aha!' you will say, 'I smell assignats!' Not so, however. Assignats were on general security of state property. Our proposition is for the pledging of individual property to the state, for the consideration of national bank-notes, instead of to individuals on mortgage. There seems no apparent reason why a man should not issue his own notes on the deposit of his own property, other than that in such a confusion of notes uncertainty might arise as to forgeries, and they might be at a discount. Issued by the state, and on real security, to the value of one-half the real property of the country, it is probable the notes would pass current in all parts of the civilized world. If a man failed to pay the interest on the notes he had taken upon his property, it would become saleable by the state, either whole or in portions, and out of this might gradually grow up a better disposition of land, into portions adapted to produce the best results."

It will at once be observed that the author might with propriety have enlarged his topic, and unravelled some of the consequences which must necessarily flow from his scheme, if put in practice. This, however, he has not done, and we cannot do it for him. There are hundreds of men in "the city" whom these few pages would amuse for half an hour, and who, if they felt disposed for it, would be instructed by them for years.

THE NEW PATENT LAW: ITS HISTORY, OBJECTS, AND PROVISIONS; WITH COMMISSIONERS' RULES AND PRACTICAL FORMS, &c. By Thomas Webster, Esq., M.A., F.R.S., Barrister-at-Law. Pp. 94. London: Elsworth.

Mr. Webster introduces this pamphlet as being a useful manual for inventors in the arts and manufactures, in the present transitionary state of all proceedings connected with patents for inventions; and as such, our readers interested in patents will find it of considerable service.

The rules of the Attorney and Solicitor-General, issued the day before the new law came into operation, having been altogether withdrawn, and the rules and regulations of the Commissioners having been considerably modified, Mr. Webster has published a reprint of a portion of his little book, containing the amended rules, and has also given an extended introduction, with some observations upon the working of the new system. Unfortunately, since Mr. Webster's second edition has appeared, the Commissioners have entirely withdrawn their former rules and regulations, and have substituted new ones; so that, notwithstanding Mr. Webster's anxiety to give the public a clear idea of the present law and practice, this is, unfortunately, not yet accomplished. The chief value of the book lies in the chapters on the history, and the objects and provisions, of the new law.

The book being merely for a temporary purpose, is, however, open only to criticism so far as it fulfils that purpose, or otherwise; and having found it convenient for reference, and useful in the course of our own labours, we may fairly recommend it to our readers.

DESCRIPTION OF AN INCLINED PLANE FOR CONVEYING BOATS FROM ONE LEVEL TO ANOTHER ON THE MONKLAND CANAL, AT BLACKHILL, NEAR GLASGOW. By James Leslie, C.E. 3 Plates. Pp. 16. Edinburgh: Neill & Co. 1852.

This is a reprint from the Transactions of the Royal Scottish Society of Arts, of a paper read by the author on the 28th April, 1851, for which he obtained the silver medal and plate—value, fifteen sovereigns.

The inclined plane is an engineering expedient, adopted in some canals to overcome the obstacles of great difference of level, combined with insufficiency of water. Though by no means a modern invention—having been adopted on the Ketley Canal, in Shropshire, as early as 1789—it is not one frequently met with; as from the difficulties generally attending it, it is only resorted to where other methods fall short of the requirements.

In the instance before us, the adoption of the plan has been attended with complete success.

"At one time, the canal was in such an unprosperous state, that it was seriously contemplated to fill it up; and it is understood that the chief, if not the only reason why that intention was not carried out, was the want of pecuniary means. As matters have turned out, it is very fortunate that the company could not spare funds to fill up the canal; for the original £100 shares, which were at one time down to £5 or £7, afterwards rose to be worth about £3,200. This remarkable rise in the value of the canal stock, may afford some encouragement to the shareholders in some of the many unremunerative undertakings of the present time.

"This prosperity was brought about mainly by the gradual development of the mineral riches of the district, aided materially, however, by the farther extension of the canal, and by other new works and improvements."

On account of the continued increase of the traffic, which could not well be provided for by increased lockage—as great difficulty existed in obtaining water—after the plans had been considered many times, it was at length decided, towards the end of 1849, to construct the inclined plane according to Mr. Leslie's plans, the work being completed and in action by July, 1850.

There are two lines of rails on the incline, a caisson running on each, acting as counterpoises to each other, and thus lowering the amount of tractive power required.

"The two caissons are constructed of boiler-plates $\frac{3}{8}$ths and $\frac{5}{16}$ths inch thick, riveted together. They are each strengthened by thirty ribs of T-iron, and are set on a malleable iron carriage, strongly framed and braced, and raised up at the lower end, so as to keep the caisson level.

"The caissons are 70 feet long, or just the extreme length of the boats, including the rudder: 13 feet 4 inches wide, and 2 feet 9 inches deep, exclusive of wash boards, to keep the water from splashing over.

"The water is only meant, however, to be 2 feet deep, that being sufficient to float the deepest empty boat. The cross section of the caisson is, as nearly as may be, taken from the mould of the boats, with a hollow space for the keel, so as to contain as little superfluous water as possible. Each caisson has ten pairs of wrought-iron flanged wheels, similar to those of an ordinary railway carriage, whereof eight pairs are 3 feet diameter, one pair 2 feet 3 inches diameter; and, in order to keep the caisson as low as possible above the rails, the uppermost pair is only 18 inches diameter.

"There are upright timber fenders at the sides of the caissons for guiding the boats, and for fixing the sluice gearing, framed and bound across the top, so as to give greater strength. The sluices are counterbalanced, and are worked each by two racks and pinions. The weight of the carriage, caisson, and water, or water and boat, varies from 70 to 80 tons.

"The guage of the railway is 7 feet, and the distance between the centres of the two lines of rails is 18 feet 3 inches. The gradient is 1 in 10; and the height from surface to surface of water being, as before stated, 96 feet, and the length of the carriage 70 feet, the whole length of the incline requires to be 1030 feet; but an additional length of 10 feet has been allowed as a provision for the case of the water being very low in the lower reach, and, consequently, the whole length of the incline is 1040 feet.

"The rails are 65 lbs. to the yard, with flat soles, and are screwed down to longitudinal sleepers. These are of half logs where the ground is solid, laid on continuous stone blocks with cross ties 15 feet apart; but are of whole timbers, with cross bearers, resting on piles 12 feet apart, where the ground is made up and soft. There is a cast-iron ratchet-plate along the outside of each rail, also screwed down to the longitudinal sleeper; and as a means of safety, in the event of any accident befalling the ropes or machinery, there are palls attached to the carriages, working constantly into the teeth of the ratchets while the caisson is ascending, and ready to drop into them when descending, the instant the tension is taken off the rope.

"The motion is given by two coupled high-pressure steam-engines, of 25 horse power each, with horizontal cylinders. This is a much greater power than is needed during the greater part of the transit; but it is nearly all required at the time when the descending caisson is entering the water, and, so losing its gravity, ceases to act as a counterpoise; in consequence of which the engines have, for a short distance, to pull up nearly the whole weight of the ascending caisson, water, and boat.

"There is a double-friction drag on the fly-wheel, acted on by the piston-rod of a small steam cylinder, by means of which the machinery may be speedily stopped and held on.

"A pinion on the crank-shaft outside of the engine-house, 2 feet $4\frac{1}{2}$ inches in diameter, drives a spur wheel on the lying shaft, of 7 feet 9 inches diameter, having a friction wheel in its interior, which, for the sake of safety, and of preventing shocks, is made to slip when any unusual resistance is met with. The introduction of this friction wheel, which is similar to that commonly used in dredging machines, was suggested by Messrs. Yule and Wilkie, the contractors for the machinery, and is a decided improvement.

"A pinion, 2 feet $10\frac{1}{2}$ inches, on the lying shaft, drives a spur wheel of 10 feet 7 inches on the drum-shaft, which is farthest down the incline, being on the left-hand line of rails in looking down, or the further side from the engine-house. This spur wheel drives another similar wheel on the drum-shaft which is uppermost, and on the right-hand line of rails looking down, or the side nearest the engine-house. These shafts are all of malleable iron.

"It is necessary to have the two drums on separate shafts, so as to move in opposite directions, in order that the one may coil and the other uncoil the rope at the same time, both by the upper side; otherwise another drum or pulley would have been required to bring up the rope from the lower side of one of the drums. The drums or rope-rolls are 16 feet in diameter, 4 feet broad, and make one turn nearly for every twelve strokes of the engine; so that, while the engines are going at their usual speed of forty strokes (though they often go considerably faster), the caissons are travelling at the rate of about two miles an hour, and the time occupied in ascending or descending is between five and six minutes."

We may conclude this notice of Mr. Leslie's unvarnished but straightforward and business-like account of his labours, by an additional extract —namely, a postscript to the paper, dated Edinburgh, Feb. 28, 1852:—

"P.S.—EDINBURGH, 28TH FEB. 1852.—The total cost of the incline, including land, was about £13,500.

"From 20th March till 23d August, 1851, there were passed over the incline 5,227 boats up, and 225 down, making a total of 5,452. The longest day's work was ten hours, and the greatest number of boats passed in a day was 55. Rather a singular effect, and one which it may be worth noticing, is produced, in the frequently-occurring cases of the boats being taken up, for the sake of lightening the load, with rather less than the full depth of water in the caisson, which is due to the level of the canal, or when the upper reach of the canal is over-full. On the opening of the two gates or sluices, after the caisson has been pressed close to the mouth of the canal, a rush of water takes place from the canal into the caisson to level the surface, and this water being stopped by the after-end of the caisson, recoils, and forms a wave in the opposite direction, which, striking the stern of the boat, drives it with a considerable impetus out of the caisson into the canal, without any help being required from the horse. This result, which was quite unlooked-for, considerably expedites the working of the incline."

REPORT OF THE SUPPLY OF WATER TO THE TOWN OF SWANSEA. By Michael Scott, Esq., C.E. Plates. Pp. 118. London: W. Clowes & Sons. 1852.

It might be inferred from the title of this work, that it is one of local interest only; on the contrary, however, it contains a vast fund of information, brought forward skilfully and intelligibly, and capable of general application to almost any locality. Indeed it is just such a work as might be expected from the extended practical experience which its able author has had in connection with the water supply of towns under every variety of circumstance.

Mr. Scott divides his subject into three heads:—1st, The requirements, or what constitutes a good supply of water; 2d, The existing state of the supply; and, 3d, The measures to be adopted in order to remedy the defects of the existing service.

In the first division of the subject (which we propose considering, as being of general interest), Mr. Scott thus treats of *quantity*:—

"In estimating the quantity of water which should be provided for a town, it is not sufficient to base our calculations solely upon that which is distributed to other populations, although nearly equal numerically; for not only does the mode of service affect the question, but regard must be had to the character of the place, and the probable demand for trading purposes. And, besides these more obvious points, it should be remembered that the inhabitants of many towns still require enlightenment with respect to the immense advantages arising from the plentiful use of water—to be educated, if I may be allowed the expression, so as to comprehend those great sanitary truths which have long been known to medical men. For, if all populations are equally alive to these truths, how does it arise that the inhabitants of one town (Liverpool, for example) consume about 11 gallons per head per diem, whilst in another (Glasgow, for instance), nearly equal in point of numbers, the supply reaches 30 gallons per head per diem?

"There are, I grant, differences between those two towns, such as the mode of service, the former being supplied upon the intermittent principle, and the latter upon the continuous; and they also differ in quantity which runs to waste. But, being conversant with the details in both instances, I can confidently assert that, due allowance being made for these circumstances, it still remains a fact, that the quantity used in the one town is about twice as much as in the other. Not to mention minor causes, the explanation of this is, in my opinion, as follows. In the one example cited, the people have had an almost unlimited command of water under pressure for nearly half a century, and have become fully alive to the benefits to be derived from a copious use of it, as in bathing; whereas, in the other case, the mass of the population have yet to

appreciate these advantages from experience. In the one town, in houses renting at £25 per annum and upwards, baths are generally to be found, as well as various domestic conveniences; but in the other, speaking generally, these are only to be obtained at rents of £60 or £70. That the character of the population and of the locality, and the nature of the demand for trading and other purposes, will also affect the question, seems clear; for, unless under very favourable circumstances with respect to cost, no one would deem it requisite to provide the same relative quantity of water for a small community as would be necessary for the metropolis, there being causes of consumption in the latter which would not be found in the former."

With regard to *quality*, Mr. Scott proceeds thus:—

"As a beverage, it is not requisite that water should be chemically pure, for if it were so, it would be vapid. It is more agreeable to the taste when containing carbonic acid; and many people prefer our spring waters from the sandstone and chalk formations, although containing a considerable amount of saline matter, to water which contains little or none. The reasons for this may be numerous—viz., the brightness, or high refractive power of such waters, the presence of carbonic acid, the absence of organic impurities, and, in some cases, the coolness; I say in some cases, for if drawn from considerable depths, the temperature would be higher than surface waters during a great part of the year. But those ingredients which do not greatly affect water, considered simply as a beverage, may be more injurious in reference to culinary, and are decidedly objectionable in detersive operations, from their destructive effect on soap.

"The salts most generally to be found in solution in water, are the carbonates and sulphates of lime, soda, and magnesia; and, of these, the compounds of lime and magnesia are the most common causes of the quality of hardness, the sulphate of lime possessing this property in an eminent degree. Water containing the bi-carbonate of lime becomes much softer on exposure to the atmosphere, owing to the escape of carbonic acid, and consequent deposition of the lime; and this salt may be almost entirely removed by mixing hydrate of lime (or milk of lime) with the water; for the hydrate, by combining with one atom of the carbonic acid, composing the original bi-carbonate, forms simple carbonate, which, being insoluble, is precipitated, at the same time that the original bi-carbonate, being robbed of one part of its carbonic acid, is also transformed into carbonate, and deposited: the rationale of the process being, that whilst the bi-carbonate of lime is soluble, the carbonate is insoluble. This softening process has been tried upon a large scale, with considerable success; and it appears that, in the event of organic matter being present in the water operated upon, the lime, in falling, carries a part with it, and so tends to purify the water still farther by mechanical action. But, with the sulphate of lime, the case is very different; for no practicable means are known whereby this hardener can be got rid of at a cost at all commensurate with the benefit; * * * * it is not only objectionable as an irremovable hardener of water, but it is the source of the indurated scale in steam boilers, which, by obstructing the transmission of heat, causes a loss of fuel, and is difficult to displace; whereas the deposit from the carbonate, in similar circumstances, is comparatively harmless.

"Objectionable, however, as the salts of lime are in many respects, they are not without value; for to their presence we owe that protection to metallic surfaces which is so essential in the case of pipes used to convey, and cisterns to store, water. It is well known that very soft water will dissolve lead, and several instances of poisoning have occurred from its use, after transmission through leaden conduits; but, if a few grains of lime be present, especially in the form of a sulphate, the surface of the metal is protected, and the water may pass in contact with it unimpaired in purity. The destructive power of very pure water upon iron is likewise familiar to many; and, in this case also, a few grains of lime per gallon will prevent injury to the pipe."

On the question of continuous or intermittent *supply*, Mr. Scott has much to say, being, of course, in favour of the former system:—

"In the dwellings of the poor, where no apparatus is generally provided beyond a single tap, constant supply confers a great benefit, by substituting one service reservoir, or one very large cistern, for numerous small ones, or butts; and, the former being placed under competent management, the arrangement is better and cheaper, besides affording infinitely less opportunity for the defilement or deterioration of the water. Moreover, a sufficient quantity is rendered available at all times, which is seldom the result on the intermittent system.

"The same effect follows in the case of the supplies required by manufactories, such as breweries, where constant supply saves the expense of large vessels, and reduces the dimensions and cost of pipes, cocks, and similar fittings—affords facilities for feeding boilers, and filling them up, when cold, without pumps, &c., &c. The large tanks heretofore employed in such establishments were no doubt useful for measuring the quantity taken, and determining the charge made for the supply; but Mr. Siemen's beautiful invention bids fair to attain this object in a less expensive manner, by providing a very perfect water-meter—a desideratum long felt.

"For supplying shipping, including filling casks and tanks, washing decks and holds, filling new vessels to test their tightness, &c., water always obtainable under pressure is very valuable, inasmuch as smaller hose may be used, fewer men employed, and less time occupied in each operation, all of which contribute towards saving money and promoting convenience; and, as illustrating one point only, I may state, that as water is generally the last thing taken on board prior to sailing, amidst much hurry and bustle, without very considerable facilities, vessels frequently lose the tide, as it is called, or find the dock gates shut before they get out, which is a very serious matter, especially in the case of emigrant vessels, as it will probably involve a delay of twenty-four hours.

"Hitherto we have considered the subject of constant supply as a consumer's question; but there is another aspect in which it ought to be viewed, namely, as affecting the supplying body, and to them there are several advantages, the most prominent of which I will notice. The first is, that fewer men are required to attend to complaints of non-supply, and as turncocks in connection with the service for domestic and trading purposes: for, in the case of constant supply, the tenants have only to help themselves, whereas, with intermittent service, the water has to be turned on to different districts, at different periods of the day, and the turncock requires to see that the tenants are supplied, before he shuts off the water again. The second point is, that, with constant supply, many of the pipes may be smaller, if cisterns are provided for water-closets and baths, because these receptacles become filled during the night; but, if no cisterns were provided, and if the inhabitants were to avail themselves fully of the water for bathing, &c., the difference in the dimensions of the pipeage would not be great, inasmuch as the demand for water, being general at certain periods of the day, the quantity passing through the pipes requires to be correspondingly large, if the pressure is sustained so as to reach the upper floors of the houses. Thirdly, with constant supply under high pressure, that waste of water is saved, which arises, under the intermittent system, from the poorer class of consumers throwing away the surplus quantity they may have stored in various vessels from one water-day to another; and when pipes are carried *into* each house, the very force of the water tends to prevent the inhabitants from permitting it to run to waste; but, on the other hand, with outside or stand pipes, and even inside, unless taps of a superior kind be provided and kept in good condition, the waste from them may be, and frequently is, enormous, especially in the case of ball-cocks supplying cisterns provided with overflows. Fourthly, the constant pressure system has this advantage, as respects the landlords of weekly property, who may be considered as the supplying body—that it, in a great measure, prevents the tenants from abstracting the fittings, as is not unfrequently done under the intermittent system, thus furnishing the landlords with a reason for objecting to supply the necessary apparatus. Fifthly, a fertile source of annoyance under the intermittent system, namely, the contamination of the water by gas drawn into the pipes by the vacuum formed when the supply is shut off and the pipes emptied, is avoided under constant supply; because, however saturated the ground may be with gas, it can find no entrance into the mains when they are kept always full. Sixthly, the strain upon the service pipes is not so great on the constant as on the intermittent system; for, on the former, it is more nearly that due to the simple pressure, whereas, on the latter, concussions frequently arise, in consequence of the sudden admission of water into pipes either partially or completely empty, although this effect is modified by the use of cocks which open gradually. Seventhly, the oxidation of the iron of which the pipes are composed, arising from the action of the oxygen of the atmosphere, is considerably less when they are constantly charged."

Here we may remark, that one argument against continuous supply is obviated by Mr. Macneill's system of forming water-way connections, described by us at page 167, in our October number.

Price:—

"Cheapness, as inducing a larger consumption, should also be aimed at for trading supplies; for as no one denies the desirableness of extending trading operations, so it should be remembered how essential to many manufactures is a plentiful and cheap supply of water.

"Even at the best, the cost of water is a large item in many trades, brewing for instance, and entails considerable expense upon the shipping frequenting the port; and therefore, in seeking to encourage commercial enterprise, it would be wise to reduce the charge to a minimum; whilst for sanitary purposes, a high price would prevent the employment of water to such an extent as might otherwise be desirable. As to power, of course high rates of charge would be fatal to the employment of water; and it ought not to be forgotten, that all these react upon the price for domestic purposes, inasmuch as a certain revenue must be raised, whilst a largely increased sale would not add materially to many items included in the annual expenditure."

Here we end our extracts; but, did our space admit of it, we would gladly transfer to our pages much more valuable matter from Mr. Scott's excellent book. The development of the subject is assisted by a very good plan of Swansea and the adjacent district, as well as diagrams and several elaborate tables and estimates.

We should rejoice to see a more general adoption of this system of putting on record the results of practical experience in matters of such public interest, and which are at present attracting so much attention in all parts of the kingdom, in connection with sanitary reform.

CORRESPONDENCE.

THE CATAMARAN.

The catamaran used by the native fishermen at Madras, is formed of three planks of timber, tied or lashed together with coir or other rope; the centre plank, being the longest, is about eight feet in length. On this the fisherman sits, and by means of his paddle keeps the head of the catamaran direct towards the coming mountain wave, and having given sufficient impetus to the craft to penetrate the wave, he dives under the wave, and comes up in smooth water on the other side. He has thus to pass through three such mighty waves, before he arrives in the comparatively tranquil sea. If he did not dive at the proper moment from the catamaran, he would be washed off it, in a way that would disconcert his movements.

JOHN NORTON,
Late Capt. 34th Regt.

CAPTAIN NORTON'S SUBMARINE PETARD, OR CATAMARAN PERCUSSION SHELL.

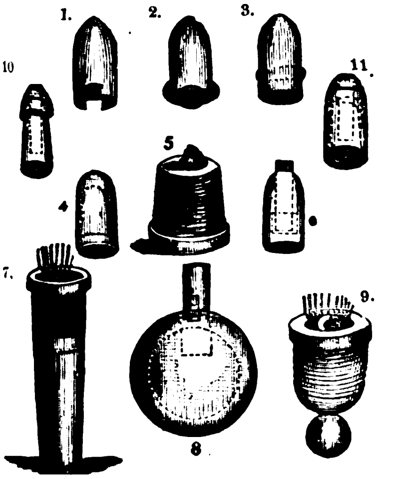
I have successfully tested this shell after the following manner:—The shell was formed of wrought-iron, being three inches long and three inches in diameter; it was drilled an inch and a half deep, the diameter of the bore being one inch, leaving the shell an inch thick. I charged it with about four drachms of fulminating powder, and stopped it with a cork fitting close. In the centre of this cork was a perforation to admit the military percussion cap, a tin tube two inches long, charged with fulminating mercury, and having a percussion cap on each end passed through the cork level with it, the cork projecting about the third of an inch. On the base of the shell was screwed a piece of wood of the same diameter, and two feet long; a cord was attached to the upper end of the wood; a spout of wood, four feet long, was placed perpendicularly upon a plank of deal, three inches and a half thick, and large stones placed around it to keep all secure. The shell was then put into the spout, and I let go the cord, when the shell exploded on the plank, crushing it into something like a pulp, and bursting into two parts. The effect of such a shell on a ship would not be to set her on fire, but would make a breach in her as if she had struck on a sunken rock, obliging the invaders to take to their boats and swimming-jackets, "*selon les regles.*" Had the iron of the shell been stronger, the explosion of the charge would have acted more powerfully on the plank, as then no part of the force would have gone waste by the bursting of the shell. I have since made the second practice, at Haulbowline, with my submarine petard, or catamaran percussion shell, on a deal plank* six inches thick. The explosion of the

* Like the long beam of a catamaran.

fulminating powder charge of six drachms burst a breach completely through the plank. The petard with its beam of deal timber two feet in length, rebounded and rested on the top of the spout, plainly indicating that if the beam were heavier, so as to cause a greater fulcrum, the effect of the explosion of the charge would have been more powerful. Judging by analogy, a rifle shell fired from a rifle cannon at a great range, and charged with a powerful explosive agent, would force a breach through a ship's side, although the shell itself, being spent, would rebound. A rifled thirty-two pounder would be more efficient at long ranges than the eight-inch gun, or the largest shell-gun now in use, and the necessity of carrying very heavy guns in our navy would be done away with.

Cork, November, 1852. JOHN NORTON.

[As Master-General of the Ordnance, Lord Hardinge has officially reported to her Majesty that Captain Norton is the original inventor of the elongated expanding rifle-shot and percussion shell. We append a description and a series of illustrations of his ingenious inventions:—



1, 2, 3. Cylindro-conoidal iron shot or percussion shell, with transverse lancewood bolt, as described in Colonel Beamish's appendix to Colonel Chesney's lecture.

4. Hollow cylindro-conoidal shot or percussion shell, containing its own charge or cartridge; it fits closely the bore of a smooth barrel, and being made of malleable metal or amalgam, it expands by the explosion of the charge at its thin base, and so prevents loss of power by windage.

5. Percussion appliance for spherical shells; a small percussion pellet is placed within it, and closed with a bullet encased in flannel or soft leather. On firing the gun or mortar, the bullet flies into the bursting charge and the pellet with it; on striking the object, the pellet is crushed by the powder within, and the shell explodes.

6. Percussion shell, *flat* at its base, and cast on a conical tin tube, having a cap of copper or iron on its base; when the shell is formed by casting, the tin tube forms its chamber.

7. Concussion fuze for spherical shells of the largest size; it has a small hole drilled across it within a quarter of an inch of its lower screw-thread, and countersunk at each end, so as to receive a small screw-head in each cavity; a smaller hole is drilled at right angles, and a circular groove to receive a thread is made; with a needle a thread is passed through and tied in the cut of one screw-head, another thread is passed through and tied in the cut of the other screw-head. On firing the gun or mortar, the fire of the fuze cuts the threads, and on the shell striking the object, the screw-heads fall out of their sockets, and the shell instantly explodes.

8. Percussion hand grenade. When to be thrown or let fall from an upper window, the percussion appliance is placed in the nitch in the stick where it enters the grenade. On the grenade striking the ground, the appliance ignites the charge within, and explodes the grenade; before using, the appliance is placed in a nitch at the upper end of the stick, where it is always ready for use; or a lucifer match can be passed through a small hole across the stick, the other end of the lucifer is broken off close to the stick, and on letting the grenade fall from an upper window, the friction of the end of the lucifer ignites the charge in the grenade and explodes it. The stick may be sixteen inches long, and acts as a sling to throw the grenade to a distance; there is a small stud or pin in the stick within the grenade, which causes it to hold on, and allow free action for the stick to drive home on the percussion appliance, or the end of the lucifer.

9. Concussion fuze, having a slow-match formed into a loop, and passing lengthwise through it; a few strands of quick-match pass through the loop in the upper part and support it; a musket bullet is firmly attached to the lower end of the slow-match. On firing the gun or mortar, the loop is fired by the quick-match, and holds its place till the shell strikes the object, when the bullet starts from its place, carrying the burning match into the shell and exploding it.

10. Iron chamber for a rifle percussion shell; the tube is one inch in depth, and sufficiently wide to receive within it easily a percussion cap of the diameter of the musket percussion; it is so formed, that when the lead is cast round it, the centre of gravity is forward. The tin tube with its percussion cap can measure seven-eighths of an inch; the cap, in consequence, is a little below the orifice of the chamber. The ordinary rifle ramrod will safely answer, as the percussion cap cannot be pressed upon in pushing the shell home. This shell is sure to explode on entering timber, sand, or even a sack of oakum; it will explode gunpowder through a block of deal timber ten inches thick. When formed for rifle cannon, I would use an amalgam of two parts zinc and one block tin for casting round the iron chamber.

11. Iron chamber, with the lead cast round it so as to form the rifle shell. The rifle barrel may be used as a mould to cast this shell, first inserting a sound cork, with a stud or pillar in its centre, and then fixing the iron tube on the stud, with its base *level* with the muzzle of the rifle. On casting the lead round the tube, its concave base will appear, the superfluous lead being filed off.—ED. *P. M. J.*]

WEIGHING CAST-IRON.

I have taken the liberty of sending you three rules for the weight of cast-iron. If you see in them any merit, you will perhaps give them a corner in your valuable Journal.

To ascertain the weight of cast-iron bodies, of given dimensions, in pounds avoirdupois:—

Find the solid content in inches, which, according to the figure of the body, may be either cubic, spheric, or cylindrical, then proceed as under.

For Cubic Inches.—To the number of inches, add its fourth part, written two places to the left, and set off two decimal places, thus—

Content, . . 5184
1296

1347·84 lbs.

For Spherical Inches.—Beneath the number of inches write its third part, and its third part written one place to the right; add, and divide by ten—

Content, . . 5184
1728
1728

708·48 lbs.

For Cylindrical Inches.—Multiply by two, and add a twentieth, and divide by ten—

Content, . . 5184

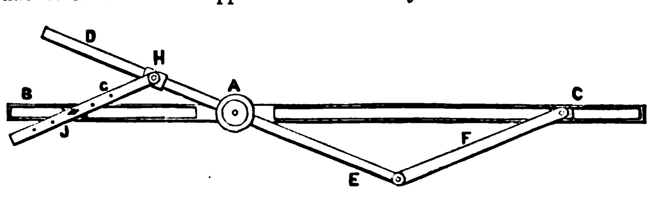
10368
259

1062·7 lbs.

J. M'F. G.
Greenock, November, 1852. Cartsdyke Foundry.

SIMPLE PENTAGRAPH.

The *Practical Mechanic's Journal* for last month, in addition to my own little contrivance, contains another arrangement for a similar purpose, reminding me of a plan which occurred to me some months back. This I did not venture to call original, as it merely involved a principle which has for centuries been applied to the same object. It is this:—Let A be



a fixed point, and B C, D E, two rods oscillating independently upon it. On one side, a link, F, is jointed to the end, D, whilst its opposite end slides freely in a slot in the rod, B C. On the other a similar link, G, is jointed to a centre, H, adjustable at different distances along the rod, D E, whilst its other end, J, traverses along the slot in B C; the length of the link, F, being made constant, and of such a length that it may be parallel with the link, H J. If, then, two pencils are attached to B C respectively, they will trace out similar figures whose polar co-ordinates are in the ratio of C E : H J.

Peculiar accuracy is secured in this arrangement, as any error in the joints is, as it were, corrected by the pencils being compelled to traverse in the line of the straight rod, B C. It is evidently the same instrument as that by "Goosequill," the two sides of the parallelogram being removed for the substitution of their diagonals. It will, of course, be less troublesome and cheaper.

ROBERT FORSTER, JUN.

Dublin, November, 1852.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

MEETING OF THE BRITISH ASSOCIATION AT BELFAST.

We have already given abstracts of the most interesting papers read at the Belfast meeting, and now append a list of the rest, which we cannot otherwise notice.

SECTION C.—GEOLOGY AND PHYSICAL GEOGRAPHY.

"Geological Structure of the Counties of Down and Antrim," by Mr. Bryce.

"On the Fossiliferous Beds of the Counties of Down and Antrim," by Mr. M'Adam.

"On the Permian Fossils of Cultra," by Professor King.

"On the Alps in the Vicinity of Mont Blanc," by Major Chartres.

"On the Subdivisions of Leptæna," by Professor M'Coy.

"Observations on the Diamond," by Sir David Brewster.

"Report on Crag Formation and Coprolites," in a letter from Mr. Long.

"On the Conditions under which Boulders occur in Scotland," by Mr. Smith of Jordanhill.

"On the Disposition of Granite Blocks in Argyllshire," by Mr. Bryce.

"On the Occurrence of Glacier Moraines in Arran," by Professor Nicol.

"On the Geology of a portion of the Himalaya Mountains," by Major Vicary of Wexford.

"On some Peculiarities of Granite in certain Points of the Pyrenees."

"On some Points in Geological Theory," by Mr. Hennessey of Cork.

"On certain Furrows and Smoothings on the Surface of Granite, caused by Drift Sand at the Cape of Good Hope," by Dr. Stranger.

"On the Mode of Succession of the Teeth of Cochliodus and Poecilodus," by Professor M'Coy.

"On the Geological Structure of Spain," by M. De Verneuil.

"An Account of the Changes in the Cooling of the Granite of Mont Blanc," by M. Achille Delesse.

Professor M'Coy made a communication in reference to the discovery of a Fossil Fish by Captain Jones.

"An Account of the Researches of German Geologists," by H. Hennessey.

SECTION D.—ZOOLOGY AND BOTANY, INCLUDING PHYSIOLOGY.

"Report upon Researches into the Structure of the Ascidians," by Mr. T. H. Huxley, Surgeon, R.N.

"On the Signification of the Ovigerous Vesicles in the Hydroid Polypes," by Professor Allman.

"On a peculiar Structure in some of the Marine Bryozoa, indicative of a difference of Sex," by the Rev. T. Hincks.

"Catalogue of the Shells found in the Alluvial Deposits of Belfast," by Mr. J. Grainger.

Dr. Lankester read the "Twelfth Report of a Committee appointed to make Experiments on the Growth and Vitality of Seeds."

"On the Geographical Distribution of Animals in connection with the Progress of Human Civilization," by W. Ogilby, Esq.

"On the Character of the Sertularian Zoophites," by Mr. Wyville Thomson.

"On the Development of the Fermentation Fungus in the Fluid of the Warm-water Flax-steeps," by Professor Allman.

"On a Microscopic Alga as a Cause of the Phenemenon of the Colouration of Large Masses of Water," by Professor Allman.

"On the Distribution of the Marine Algæ on the British and Irish Coasts, with reference to the probable Influence of the Gulf Stream," by Professor Dickie.

"On a New Species of Acaleph from Belfast Bay," by Mr. Hyndman.

"On some Fishes, Crustacea, and Mollusca, found at Peterhead," by Mr. C. W. Peach.

"On a New Map of the Geological Distribution of Marine Life, and on the Homoiozoic Belts," by Professor E. Forbes.

"On the Homologies of the Cranial Vertebræ," by Professor Owen.

Dr. Gladstone gave an abstract of a paper which he had read in the Chemical Section, "On the Influence of Light on Plants."

"On a Singular Locality chosen for its Nest by the Black Redstart *(Sylvia Tithys)*," by Dr. M. Barry.

"Notice of a Monstrosity of *Bellis Perennis*," by Professor Dickie.

"On the Transmutation of Ægilops into Triticum," by Major Munro.

The President made some popular remarks "On the Relations existing between the Organic Structure of Quadrupeds, and their Habits, Economy, and Intellects."

"Remarks on the Flora of the South and West of Ireland," by Prof. Balfour.

"On the Forces by which the Circulation of the Blood is carried on," by Prof. Wharton Jones.

"On the Question, What is the State of the Mind and Vitality during Perfect Sleep, and the Sleep in which we Dream?" by Dr. Fowler.

Dr. J. D. Marshall exhibited specimens of the "Bonaparte's Gull," "Sabine's Gull," "Little Auk," and some other fowl, all shot in the neighbourhood of Belfast.

"On the Part played by the Cavernous Sinus in the Circulation of the Brain," by Dr. J. Barker.

"On the Altitudinal Ranges of Plants in the North of Ireland," by Professor Dickie, M.D.

"On a Peculiar Phase in the Development of an Annelid," by Prof. Allan.

"Supplementary Report on the Fauna of Ireland," by the late Mr. William Thompson, read by Mr. R. Patterson.

"On the Fresh-water Fishes of Ulster," as enumerated in the MSS. of the late Mr. William Thomson, read by Mr. R. Patterson.

"Remarks on a Species of *Sepiola*, new to Britain, and first procured in the Neighbourhood of Belfast," communicated by Professor E. Forbes.

SECTION E.—GEOGRAPHY AND ETHNOLOGY.

"On the Ancient Harbour of Seleucia in Pieria, near the mouth of the River Orontes, North Syria, with some Suggestions as to the Means by which it might be restored to Use," by Capt. W. Allen, R.N.

"On the Ethnological Bearing of the Recent Discoveries in connection with the Assyrian Inscriptions," by Dr. E. Hincks.

Other papers read were, "On the Geographical Distribution of Common Salt," by W. Bollaert, Esq.,—"Description of a Samoied Family," by J. W. Giles, Esq., —and "On the Aurora Borealis," by Sir John Ross.

"On the Site of certain Ancient Mines," by the Rev. Dr. Hincks.

"Notes on the Distribution of Animal Life in the Arctic Regions," by Mr. A. Petermann.

"On the Comparative Merits of the Proposed Routes to India," by Colonel Chesney.

"On the Connection between the Indian, European, Semitic, and Egyptian Forms of the Personal Pronouns," by the Rev. Dr. Hincks.

"On the Present State of Medo-Persic Philology," by Professor M'Douall.

"On a Recent Journey across Africa," as communicated from Her Majesty's Foreign Office to the Royal Geographical Society.

"Latest Explorations in South Africa to the North of Lake N'gami."

"Expedition, under Mr. F. Galton, to the East of Walfisch Bay."

"An Attempt to account for numerous Proofs for sudden and violent Drainage, in the Valley of the Dead Sea, with a proposition for a New Line for a Ship Canal to the East Indies," by Captain William Allen, R.A.

"Late Explorations in Syria and Palestine," by the Chevalier Van de Velde, of the Dutch Navy.

"On the most Rapid Communication with India, *via* British North America," by Captain Synge.

"The Origin, Characteristics, and Dialect of the People in the Counties of Down and Antrim," by the Rev. Dr. Hume.

"Recent Survey for a Ship Canal through the Isthmus of Central America," communicated through the Royal Geographical Society, by the Foreign Office.

"On the Misapplication of the Terms Development and Evolution."

"Notes on Blumenbach's Classification of the Human Race," by R. Cull.

"Remarks on a Collection to illustrate the Ethnology of Java," by Dr. Biallo-blotzky, in a letter to Dr. Hodgkin.

"On the Expedition to the Interior of Central Australia in search of Dr. Leichardt."

"On the Upper Nile," by Consul Vandey.

SECTION F.—STATISTICS.

"On the Census and Condition of the Island of Bombay," by Lieut. Col. Sykes.

"On the Productive Industry of Paris," by the late Mr. G. R. Porter.

"Are there any Impediments to the Competition of Free Labour with Slave Labour in the West Indies?" by Professor Hancock.

"Excessive Emigration and its Reparative Agencies in Ireland," by Mr. J. Locke.

"On the Statistics of the Province of Nova Scotia," by D. M'Culloch.

"On the Neglected and Perishing Classes, and the Means of their Reformation," by Dr. Edgar.

SOCIETY OF ARTS.

THURSDAY, 29TH APRIL.

SIR J. RENNIE IN THE CHAIR.

Mr. Longmaid "On improvements in treating Copper Ores, in the separation of Silver and Copper, and the recovery of Sulphur from Alkali Waste." After alluding to his recent discovery, that when common salt, and minerals containing silver, copper, iron, and sulphur, are mixed together, and exposed to the combined action of heat and atmospheric air, mutual decomposition ensues, with formation of sulphate of soda, and chloride of silver and copper, soluble in the alkaline solution thereof, he showed that every description of ore containing silver and copper might be treated with great advantage by various modifications of either of these processes, and the silver and copper economically obtained. The waste of sulphur in the copperworks of Great Britain, at an enormous cost of labour and coal, was stated to be from 60,000 to 70,000 tons annually. From this, the original idea was to manufacture sulphate and carbonate of soda. He then minutely described his late patent, as applicable to ores rich in silver and copper, which before had been supposed to be out of the reach of his former discovery.

The Rev. C. G. Nicolay, librarian to King's College, followed Mr. Longmaid, and read "An attempt to combine the peculiar characteristics of the most remarkable Models of Vessels in the Great Exhibition." After noticing at some length the immense varieties of forms of vessels constructed by ship and boat builders, among which no one law of construction seemed to have been applied, he divided the models in the Great Exhibition into three classes:—1. Those of the Indian seas; 2. The yacht models; 3. Merchant and fishing vessels; and deduced, from close examination, that the peculiar characteristic of the Eastern models is breadth; of our yachts, depth; of our steamers, length; and that all want capacity. With regard to the sails, Mr. Nicolay observed that the relation of the sails of a vessel to the wind has not been properly understood in this country. This was sufficiently proved in the case of the yacht *America*, in which the cut of the sails was remarkable. Mr. Nicolay proposed to take from the Eastern models their breadth of beam; from our own yachts, their depth in the water; from both, their hollow floor and clean cuttance; from others, their breadth, if not abaft, at least amidships; from the Eastern models, the triangular form of the sails; and to obtain easy motion every way, to reduce the number of curves on which the model was formed to the lowest possible limit, namely, two.

Wednesday, 5th May.
Henry Cole, Esq., C.B., in the Chair.

Mr. Henry Forbes, partner in the firm of Forbes, Milligan, & Co., of Bradford, and deputy-chairman of Jury XII. at the late Exhibition, proceeded to deliver his discourse "On the Rise, Progress, and Present State of the Worsted, Mohair, and Alpaca Manufactures of Great Britain." He began by reminding his hearers of the difference between worsted goods in which the wool had been "combed," and woollen goods in which it had been "fulled" or "felted." Worsted derives its name from a village in Norfolk, where these goods were first produced, in the reign of Edward the Third, at the beginning of the fourteenth century. During the eighteenth century, the trade extended itself over various parts of England, but principally in the West Riding of Yorkshire. The introduction, in 1790, of the spinning machinery gave the trade its first impulse, and the new machinery was first applied in Bradford in 1793. The trade has now entirely passed from Norfolk, which *did not*, to Yorkshire, which *did*, adopt the new machinery. In 1830, again, great improvements took place in the modes of dyeing and finishing alpaca, which is the wool of an animal of the Llama tribe of Peru, was introduced; and very nearly at the same time mohair, or goat's wool, from Angora in Asia-Minor. The woolcombing machinery exhibited in Hyde Park, is the last great improvement which has taken place in the manufacture. After observing upon, and furnishing statistical accounts of, the remarkable increase of the population of Bradford, attendant upon the increased improvements in its trade, the lecturer described a new factory, now in course of erection by Mr. Titus Salt of Bradford, which is to contain 1140 looms, and give employment to 4500 hands. Mr. Forbes then minutely described the various fabrics of this manufacture, and gave statistics of the annual value of the goods produced. He estimated this, at present, to amount to twelve-and-a-half millions sterling. Fully two-thirds of this appertain to the West Riding. The exports are about fifty-nine per cent., chiefly to the United States and to Germany.

Thursday, 6th May.
Wentworth Dilke, Esq., V.P., in the Chair.

The Rev. W. W. Cazalet, Superintendent of the Royal Academy of Music, and associate Juror in Class X. (*a*) of the Exhibition, read a paper "On the Musical Department of the Exhibition." He began with detailing concisely the history of the "king of instruments"—the organ—and its various improvements, mentioning the principal features shown in the construction of the several instruments exhibited. Among these was one in the Florentine department, by Messrs. Ducci, in which was produced a complete chromatic scale from one pipe, and a method of making a stopped pipe produce the sound of one four times its length. This was stated as calculated to lead to great improvements and modifications in the instrument. We cannot, of course, follow the lecturer in all his discourse, and must select one observation. In speaking of the finger wind instruments, Mr. Cazalet gave, at some length, a highly interesting account of the early flute, and of the difficulties in its construction. Mr. Boehm, of Munich, was among the first who applied acoustic science to its formation, particularly with regard to the position and shapes of the holes. By this means he produced an instrument in which, the lecturer observed, perfect equality of tone is combined with correct intonation. This improvement had received the Council medal. Mr. Cazalet finished his discourse by suggesting the formation of a Musical Art-Union.

Wednesday, 12th May.
Earl Grey in the Chair.

Mr. G. Boccius read a paper "On the Artificial Spawning, Breeding, and Rearing of Fish," whereby the breeds may be improved by a system of crossing, similar to that to which our cattle and domestic animals owe their present excellence. It was stated that some very successful results of this method had been obtained in the waters of the Duke of Rutland, the Duke of Devonshire, Earl Ducie, Mr. Gurney, and others.

Wednesday, 19th May.
Robert Stephenson, Esq., M.P., in the Chair.

Professor Ansted delivered his discourse "On the Non-metallic Mineral Manufactures in the Great Exhibition." He began by distributing the subject into—(1) marble and stonework; (2) cements, scagliola, and artificial stone; (3) bricks, terra-cottas, and other works in clay. In the course of the lecture, it was stated that, since the Exhibition, a great demand had been made for the Derbyshire marble for the construction of articles of domestic requirement. The novel and beautiful serpentine of Cornwall was also alluded to. The Russian malachites were, of course, referred to; and it was mentioned that the cost of the material was 14s. a lb., two pounds being wasted for every one used; and that, for the well-remembered doors, no less than 3000 lbs. weight of rough malachite were required, at a cost of not less than £2000, exclusive of labour. With regard to cements, it had been ascertained, by experiment, that the Portland artificial cement was stronger than the natural Roman, in the relation of two to one.

MONTHLY NOTES.

Science and the Throne.—"The advancement of the fine arts and of practical science, will be recognised by you as worthy of the attention of a great and enlightened nation. I have directed that a comprehensive scheme shall be laid before you, having in view the promotion of these objects, towards which I invite your aid and co-operation."—*Her Majesty's Speech.* The annual speech of Royalty does not often contain allusions to "practical science." Let us hope that the paragraph which we have culled from Her Majesty's last oration, may be the precursor of some substantial acknowledgment of the debt which our country owes to the combined labours of the disciples of science. We are, at any rate, assured that, amidst the gaieties and state of Royalty, science is not quite forgotten, nor its benefits wholly ignored.

The New Patent Law.—The process of passing patents seems to have been heightened in complexity, rather than simplified by the recent change of the system. Although upwards of 800 applications for patents have been made up to the 25th of last month, not one patent has been sealed under that act. Unnecessary delays appear to arise at every stage, and "a poor man's tale of a patent" would be considerably lengthened, were he to tell it over again under the existing system. A period of a week elapses before an inventor is informed of the law officers' approval, or otherwise, of the title and provisional specification; and when he has obtained the certificate of their approval, another week, or, in some cases, ten days, intervene, after he has given notice of his intention to proceed, and before that notice is advertised in the *London Gazette*, after which an unnecessarily lengthened period of twenty-one days is allowed for parties to enter the grounds of their opposition. This stage having been passed, a delay of ten days has been allowed to take place as to applications made on the 1st of October, before any information could be obtained as to where the ulterior proceedings are to be conducted. This is understood to have arisen from a doubt whether one office should not prepare all the documents necessary for the passing of patents, or that there should be a separate office for preparing the warrant. This has at length been decided in favour of the additional, and, as it appears, quite unnecessary office. It is as yet a matter of uncertainty how often, and at what intervals, patents may be sealed; but it is to be hoped, for the credit of the great Chancery reformer of the day, that inventors will not be saddled with the expenses of special seals and journeys, which added so much to the hardship of the old system.

The Electric Telegraph in America.—The total number of miles of telegraph in the United States is 27,177, independent of the range of lines projected or in progress. Of this 27,177, about 17,283 miles are on the Morse system, and the remainder on that of House, Bain, and O'Reilly. The longest existing line is that between New Orleans and New York, by means of which, in April last, direct communication between the two cities, in a single circuit, over an extent of 3,000 miles, was obtained, despatches being sent between the two places 60 seconds "ahead of time." The next longest line out of the 44, on the Morse system, extending to all the chief states, are the New York and Buffalo Telegraph, *via* Troy and Albany, consisting of five lines, each 500 miles long, or a total stretch of 2,500 miles; the Washington and New Orleans Telegraph, *via* Virginia, 1,716 miles; and the Washington and New York Telegraph, *via* Baltimore and Philadelphia, with five lines of 250 miles each, or a total of 1,250 miles. Other lines vary from 100 to 300 and 800 miles long, and the expense of their construction from 100 to 200 dollars per mile, the profits alternating at between 3 and 6 per cent. per annum. The number of wires also varies, there being between some places only one, and between others, two, four, and five. On the Western and Canada routes there is generally but one. The Washington and New Orleans Telegraph charge 2 dollars from Washington to New Orleans, 1,716 miles, with no charge for address, date, or signature. The Atlantic and Ohio Telegraph, 1 dollar and 30 cents, from Philadelphia to Milwankie, 812 miles. The Magnetic Telegraph, from New York to Washington, 245 miles, 50 cents; and to New Orleans, 2 dollars 50 cents; but when a communication exceeds 100 words, the price on all words exceeding is reduced one-third. The New York and Niagara Telegraph charge 65 cents for 500 miles. These charges are the same to all places on the intermediate route, each line running its wires through numerous towns and cities where telegraph stations are established. The route selected for the great Californian Telegraph, extending over 2,400 miles, by the committee on the measure in their report to the Senate of the United States, will commence at the city of Natchez, in the State of Mississippi, running through Northern Texas to El Paso, on the Rio Grande, thence to the junction of the Gila and Colorado rivers, crossing at the head of the Gulf of California to San Diego on the Pacific, and then skirting the coast to Monterey and San Francisco. The committee report, that if this line of wires be established, the Pacific and Atlantic oceans will, for commercial communications, become as it were as one, and that intelligence will be conveyed from London to California and India in a shorter time than was required ten years since to transmit a letter from Liverpool to New York.

PHOTOGRAPHY IN THE PROVINCES.—The efforts made by Mr. Urie, a young photographic artist of Glasgow, for the improvement of his art, as well as the extension of the practical limits of the process, have already been chronicled in this *Journal;* and we are, perhaps, not going out of our routine of subjects, in reporting upon his progress in that partially-developed branch to which he has the credit of applying himself with greater assiduity than any of his contemporaries. Our readers will be aware that we refer to the collodionized glass process. In addition to working out the idea of "light-drawn pictures" on the wood, for engraving—the success of which has been so repeatedly evidenced in these pages—Mr. Urie has been no less successful in his attempts at portraiture, and the copying, enlargement, and reduction of pictures. Certainly nothing whatever has yet been accomplished, which can at all be compared to the combined sharpness and accuracy of outline, and the artistic shadowy effect which are visible in his pictures. With all the difficulties of a far-off provincial artist to contend with, he may reasonably be proud of the results of his patient industry.

SUTTON AND ASH'S WATER-SPACE ANGLE-IRON.—A very useful section of what the inventors term "Water-space angle-iron," has lately been registered and introduced by Messrs. Sutton and Ash, the iron merchants of Birmingham. It is somewhat S or Z-shaped in transverse section, being, in fact, a duplex angle-iron, with the external edge flanges turned in reverse directions, with either square or rounded bends. It is especially intended for the bottoms of the water spaces of fire-box boilers, for which purpose the new form has more than one practical advantage. Facility is given by it for the external riveting, whilst the deposited mud can be easily removed.

MAST-HEADING THE COMPASS IN IRON SHIPS.—The *Andes*, a new Clyde-built iron screw-steamer, of the Liverpool and New York line, carries her compass on the top of her mizen-mast, this isolated position having been chosen for the prevention of the local attraction so dangerous in iron ships. We shall no doubt learn when she sails this month, how this novel expedient answers. The *Andes* was built at Dumbarton by Messrs. Denny, her engines being made by Messrs. Tulloch & Denny, of the same place. She contains a good many minor novelties—not the least important of which is a small detached steam-engine for performing a great part of the drudgery of the ship. This is an application which must soon become universal in steamers of large size. It is also worthy of remark, that an architect was called in to design and superintend the saloon decorations. The saloon is 55 feet long, having twenty-four marble Corinthian columns on each side. The capitals and bases of the columns, and other ornamental devices, were electro-plated at the Scottish establishment of Dr. F. Thomson at Glasgow, and the whole decorative works were most satisfactorily executed by Mr. Rochead, an architect of the same place.

OUR TEXTILE MANUFACTURES.—The forests of chimneys which, in Lancashire, Yorkshire, and some parts of Scotland, tell so plainly of the immensity of our factory system, usually impress the casual observer with the idea, that manufacturing enterprise has outgrown itself, and even become a mere unmanageable excrescence. But what does Mr. Leonard Horner tell us? Why, that in place of any diminution in the means of production, not fewer than eighty-one new factories were set to work last year, (up to October,) in the limited district of Manchester alone. And to work these new mills, 2,240 steam horse power were required, besides 1,477 horse power to work the machinery consequent upon the enlargement of old mills. This gives a total increase in the district of 3,717 horse power, affording additional employment to somewhere about 14,000 hands. The still greater abundance of capital since this time, shows itself with even greater results, and we now learn that new factories of extraordinary magnitude are springing up on every side. We should exhaust the space of a page of our print, were we to attempt the bare recapitulation of these new concerns. But of the more notable ones, we may mention that of Mr. Titus Salt of Bradford, for the manufacture of alpaca. This mill will cover six acres, the principal building being a fine stone edifice, containing a single room 540 feet long. Messrs. Fairbairn are engaged in the construction of the engines, of 1,200 horse power, and the mill gearing; and the gas-works, rivalling those of a moderately-sized town, are being erected by White's hydro-carbon gas company. They will cost £4,000, supplying 5,000 lights—the power of production being 100,000 feet of gas per day. Mr. Salt is also colonising the place by building 700 workmen's cottages. The total cost of this unrivalled undertaking is calculated at half a million. Great Britain must prosper whilst her textile manufactures flourish.

THE INDUSTRIAL EXHIBITION OF 1853.—With the balance-sheet of the successes and failures of the Great Exhibition of 1852 before them, the people of Dublin, incited by the nobleness of their countryman, Mr. Dargan, have set themselves steadily to work, to get together a collection worthy of being named, "The Industrial Exhibition of 1853," aided by Mr. Dargan's gift of £26,000. Many of the early difficulties of such a scheme are smoothed away; and taking good heed of the right and the wrong of last year's proceedings in Hyde Park, the promoters have every chance of securing a splendid display, which shall leave enduring traces of instructive teachings behind it. The lawn of the Royal Dublin Society has been fixed upon as the site for the Exhibition. The building will be provided for the exhibitors free from rent, and the productions of all nations will be admitted. The general plan for the division of the Exhibition will be similar, as far as practicable, to that adopted at the suggestion of his Royal Highness Prince Albert for the Exhibition of 1851, viz.,—Raw materials, machinery, manufactures, fine arts. All goods and articles for exhibition must be delivered at the building free of any charge to the committee, and at the risk of the exhibitor. The reception of goods and articles will commence on the 1st of March, and none can be received after the 31st of March, 1853. Articles and packages will be unloaded at the building. Should exhibitors, or their agents, not be present, the articles will be unpacked by the officers of the committee with the utmost possible care, but at the risk of the exhibitors. Tickets will be issued by the superintendent to every exhibitor, his agent, or servant, to enable him to pass into the building until the 1st of May, between certain hours, to arrange the articles for exhibition, which ticket he will be called upon to produce on entrance, and give up when required. Rough counters and wall space will be provided, and the most effectual means will be taken, through the agency of the police and otherwise, to guard against fire and protect the property in the Exhibition; but the committee cannot be responsible for losses that may be occasioned by fire, robbery, accident, or damage of any kind. Exhibitors may employ (under the regulations of the committee) assistants to preserve and keep in order the articles they exhibit, or to explain them to visitors. Free admission, within certain limits, will be given to exhibitors or their agents. Exhibitors cannot remove their goods, or substitute others for them, during the period the Exhibition shall remain open. The prices of articles exhibited may be affixed. The steam and water power required for the purposes of the Exhibition will be supplied gratuitously. Shrubs and flowers will be admitted into the building for the purpose of ornament. Highly inflammable articles will not be admitted. Each person or firm intending to exhibit will have to fill up a form of application for space, and to transmit it to the secretary. As it is the intention of the committee to examine and decide upon these applications as soon as possible, exhibitors are requested to return the form at their earliest convenience; and in no case can an application for space be received later than the 1st of December, 1852. Suitable storage will be found for all packing-cases, and the goods exhibited will be repacked with the utmost possible care, but at the risk of the exhibitor. Every article sent separately, and every package, must be legibly marked with the name of the exhibitor or exhibitors, and also with the section and class, whether raw materials, machinery, manufactures, or fine arts, in which it is proposed the articles shall be exhibited. The railway and steam-packet companies have kindly consented that articles exhibited and not sold shall be conveyed back by the same route as they were forwarded, free of charge. The committee propose, at the earliest period, to take the necessary steps for procuring an Act of Parliament to facilitate the registration of designs proposed for exhibition, and to protect exhibitors against piracy. The general objection to prizes has induced the committee to determine that none shall be awarded. The building, of which a spirited lithograph, by Mr. M'Glashan, the Dublin publisher, has been laid before us by Mr. J. C. Deane, the assistant secretary, is being erected from the prize designs of Mr. Benson, C. E., of Cork; the iron-work being contracted for by Messrs. C. D. Young & Co., of Edinburgh. Presenting a front to Merrion-square of 300 feet, the main or centre feature of the elevation consists of a semicircular projection, which forms the eastern termination of the central hall. This will be a noble apartment of 425 feet in length, and 100 feet in height, covered by a semi-cylindrical roof upon trellis ribs, in one span of 100 feet. On each side of the centre hall, and running parallel to it for the same length, are two halls 50 feet wide, with domed roofs, similar to that which covers the main nave of the building. The height from the floor to the roof of each of these halls will be 65 feet. They are approached through passages from the centre hall. In addition to these are four compartments of 25 feet wide, running the whole length of the building; two are placed between the centre hall and the side halls, and two on each side of the latter, divided into sections of 25 feet square, forming convenient divisions for the purposes of classification. Over these compartments are spacious galleries, also running the length of the building, which will not only afford increased space for exhibition, but be an agreeable promenade, from whence the effect of the three halls will be seen to great advantage. The ceiling being divided into panels formed by the trellis ribs, and the other constructive parts of the building, will provide ample opportunity for effective decoration. Light is admitted from above in one unbroken and equally distributed body. The construction of the building is strongly marked on the elevation, and forms, in fact, the ornamental character of the design. There are also external galleries, which will be attractive features in the exterior, and will be useful in providing access to the roof for repairs, &c. The termination of each of the principal roofs to the east and west is semi-spherical, giving strength as well as effect to the building. There will be three entrances in the front facing Merrion-square, under a range of verandahs, through which access will be had for the holders of season tickets and the general public. The materials of the building will be iron, timber, and glass. The latter will only be used for light, as before described. The roofs at each side of the lights will be timber, covered with water-proof cloth, manufactured by Messrs. Malcomson, of Portlaw, county Waterford. The trellis girders which support the galleries will be of wrought-iron, supported on cast-iron pillars. Ample accommodation in the way of refreshment, retiring rooms, offices, &c., is provided in the plan. Access to the building can also be had by the spacious court-yard of the Royal Dublin Society, whose suite of apartments, including the Museum, will be thrown open to the public during the Exhibition. The available area of ground floor will be 147,704 feet. Of wall space there will not be less than 87,000 feet. The Directors have done well in rejecting the prize system, and we think they have committed no error in allowing prices to be affixed, provided care is taken that the Exhibition shall not be turned into a mere magnified copy of the Pantheon or Soho bazaars. It is also of importance to distant contributors, that their unsold goods will be returned free of cost, whilst "every foreign article," destined for the Exhibition, shall be gratuitously transported from the port of embarkation to Dublin, and, if not sold during the Exhibition, back again to the same port. Under the management of that cleverest of railway secretaries, Mr. Roney, with his assistant, Mr. Deane, the working details promise to be most satisfactorily elaborated. Indeed the movement already made, and the interest already created in its behalf, are evidences that Ireland will next year give us a magnificent sequel to the show of 1851. We may add, that we have undertaken to further the objects of the Exhibition, at our offices in London and Glasgow, where blank forms of application and detailed information may be obtained.

GOVERNMENT TRIALS OF ANCHORS AT SHEERNESS.*—The fourth or steam trial series of experiments has now been concluded. The competing anchors, eight in number, were placed on board two dockyard lighters especially selected for the occasion, and towed by the *African* and *Adder* steamers to the scene of operations. Here the lighters, with standing gear attached to each, were moored in an average depth of water a quarter less 13 fathoms, the *African* and *Adder* being berthed outside of them. To the outside catheads of the steamers the opposing anchors were affixed, with stoppers ready to be cut at a given signal, the ends of a chain cable, 37½ fathoms in length, previously rove through an iron-bound single sheave-block, being attached to the anchors. The steamers, of the joint power of 220 horses, were lashed to the lighters, one on each side thereof, and on the anchors being let go (a sufficient time being allowed for their reaching the ground), were propelled astern at full speed, the power being kept on the pendant of 23 fathoms attached, for the purpose of testing the holding properties of the anchors at long scope of cable. The necessary preliminaries having been gone through, the anchors, in accordance with the drawing for stations, were assigned the following positions:—

PORT.	STARBOARD.
1. Rodgers' (Exhibition Prize).	1. Aylen's.
2. Honiball's (Porter's).	2. G. W. Lennox's.
3. Trotman's (improved Porter's).	3. Admiralty (new).
4. Isaacs' (American).	4. Mitcheson and Son's.

Everything being ready, the trials commenced, and were proceeded with in the order here given, Lieutenant Rodgers' Exhibition prize anchor being opposed to Mr. Aylen's. On steam power being applied, Aylen's was run up to the block, when it was discovered not to have taken the ground, owing, it was supposed, to the strain being applied too quickly after its being let go; hence the committee decided this should be considered as no trial. It turned out that the men employed on board the lighter had omitted to cut the stopper of Aylen's anchor until after Rodgers' had been let go, the strain of the latter in full run bringing Aylen's to the block.—Mr. Honiball's (Porter's) was next put in competition with Mr. G. W. Lennox's. This trial occupied two hours and three minutes, and was a severe one. Lennox's was drawn one link and a half of chain in twenty minutes. At length, after a protracted struggle, Honiball's was brought up to the block, but not until a large warp had been broken, and the mooring lighter, from the heavy strain caused by the steamers backing at full speed, with a tide in their favour, of 2½ knots per hour, was pinned down four feet by the head.—Mr. Trotman's improved Porter's anchor was now pitted against the Admiralty anchor, constructed on the plan of Sir W. Parker, which resulted in the latter being brought home to the block at the first trial, at long scope of cable.—Mr. Isaacs' American anchor was then tested with Messrs. Mitcheson and Son's; the former's inferior holding power was evinced by its being drawn up to the block at the long scope on the first trial. Further operations were now suspended, it being necessary to allow time for the placing of the winning anchors in new positions for testing.—A further trial now took place between Mr. Aylen's and Lieutenant Rodgers' Exhibition prize anchor. In this case full steam power was employed with 18¾ fathoms' bite of chain through the block on each anchor, cast in 11 fathoms water, with a tide in favour of 2½ knots, the steamers backing at the rate of 3½ knots—the competing anchors held firmly. On sighting the block, Aylen's was found to have gained an advantage of one fathom over its rival. The committee then proposed that the steamers should go ahead for a short distance, and afterwards astern at full speed. During the trial, Commodore Stopford superintended the steering of the steamers, in order to prevent any undue advantage being given to either anchor by steerage way. The heavy strain brought upon the gear caused the lighter to be pinned down upwards of three feet. Shortly afterwards the steamers working together up to 220 horse power, Rodgers' anchor came home, Aylen's not having started from its original position at long scope of cable. At long scope the advantage of Aylen's anchor over its competitor was so trifling, that both were considered equal in holding power, and it was not until after a most severe struggle at short stay peak that Rodgers' anchor gave way.—The two rival anchors of Trotman and Mitcheson had now to be tested against each other. Two trials were afforded them at long scope of cable, the full power of the steamers being put on without the one showing superior holding power to the other. On the first trial at short stay peak both held on. At the second, however, Mitcheson's was brought up to the block minus one-half of the stock, which, being constructed of two separate parts, shipped into the shank in dovetail groves, the breaking of the stock is supposed to have been caused by the anchor embedding itself into the ground. In consequence of this circumstance, the committee decided that Mr. Mitcheson's anchor should be further tried with its competitor, should Mr. Mitcheson choose to replace that portion of the stock which was carried away.—Lieutenant Rodgers' Exhibition prize anchor had, during the present series, been twice placed in competition with Mr. Aylen's anchor, proving victorious in one instance, and being beaten in the other. In order, therefore, to determine which possessed the greater holding properties, a third trial took place between them, which resulted greatly in favour of Lieutenant Rodgers'.—Mr. G. W. Lennox's anchor having now become next best to Lieutenant Rodgers', it became necessary to oppose these to each other. Both having been let go at the same time, the steam power was applied, when Lennox's brought his rival up to the block. The steamers *Lizard* and *Adder* then returned into port, the *African* remaining at the Nore in charge of the lighters.—Mitcheson's and Trotman's anchors were now submitted to a test, which resulted in Trotman's being speedily brought home. On reference to the results of the 17th instant, it will be seen that Mr. Trotman's anchor, after a severe contest of hours' duration, brought Mr. Mitcheson's home with a broken stock. This having been repaired at the dockyard, the two rivals were again placed in competition. A struggle was expected, but from some cause—possibly the mere accident of the one anchor falling on its stock end, and the other on its face, in which position the momentum imparted by the two steam tugs, backed at full speed, is suddenly brought to bear upon them, whereby no chance is given for the canting of the one anchor, the few fathoms of chain flew through the block, and in a very short space of time all contest was at an end. The result thus far is in favour of Mitcheson's—in the former instance to Trotman's; which makes it, so far as the trials at the Nore are concerned, a drawn affair.—Mr. Mitcheson's anchor was then pitted against Mr. Lennox's, the latter holding equally with its competitor. At short stay peak, however, Lennox's yielded to its rival, in fact broke ground first.—In accordance with the suggestions of the committee of naval officers and shipowners, the four trial plans have thus been fully carried out, whereby the holding properties, quickness in taking the ground, tripping, &c., of the competing anchors, have been subjected to every available test that the means at disposal would admit. The results cannot fail to afford many valuable hints for the further improvement of this instrument, which ought to be the most perfect within the powers of human invention, more especially with reference to its peculiar and important uses, as on the anchor mainly depends the safety of our ships and their crews when riding in furious gales. A most important property appertaining to the rival anchors—that of strength, has yet to be ascertained. For this purpose they are to be taken to Woolwich, there to be subjected to hydraulic pressure until broken. The labours of the committee will then terminate, with the exception of drawing up their report.

* See *ante*, pp. 118, 286, Vol. IV.; pp. 94, 118, Vol. V.

LONDON GAS TESTS.—The following report on the gas supplied by the Great Central Gas Consumers' Company to the City of London, addressed by Dr. Letheby to the Commissioners of Sewers, will be read with some interest:—

"Since the date of my last report, I have made 276 experiments of the illuminating power of this gas. These experiments have been conducted in the manner last described, and they have been made as usual with three kinds of burners—viz., the Act of Parliament argand, which consumes five cubic feet of gas per hour, a No. 4 fish-tail, and an ordinary bat's-wing, each of which have burned at the rate of four cubic feet per hour. The candles employed have been wax and sperm of six to the pound, the former consuming on an average 160·7 grains per hour, and the latter 130. The results of these investigations are as follow: 1. During the whole quarter the argand has emitted a light equal to that of 15 wax candles of standard consuming power—that is, of 120 grains per hour; the lowest amount of light during the quarter has been equal to 12·72 candles, and the highest equal to 16·1. In conducting these experiments, I have taken care to have the wax candles burning at their greatest intensity: this has been accomplished by turning the wick out of the flame, and so preventing the formation of a snuff or head of unconsumed carbon. When, however, the candle has been allowed to stand without interference for a period of twenty minutes, the average illuminating power of the gas has been as high as 17·4 of such candles, each consuming 120 grains of wax per hour.—2. The light evolved from the argand has been equal, on an average, to 12·31 sperm candles.—3. The light from the fish-tail burner has been equal to 10·64 standard wax candles, and 8·66 sperm.—4. That from the bat's-wing has been equal to 10·58 wax candles of standard power, and 8·51 sperm. The specific gravity of the gas, estimated at 29 of the barometer and 60 of Fahrenheit, has ranged between 400·3 and 423·8, the average having been 412·3. These results prove that the gas has been of good illuminating power; in fact, when measured by the standard wax candle burning at its greatest intensity, it has been just 25 per cent. higher than is required by the Act of Parliament, and, when compared with the same candle burning in its undisturbed condition, it has been exactly 45 per cent. higher. The chemical quality of the gas has been much improved since my last report; during a few days in the early part of August last, it contained traces of sulphuretted hydrogen, which were in all probability derived from residual impurities in the pipes. Since that time, however, the gas has been perfectly free from this highly deleterious agent. When, in my last report, I ventured to make a few remarks on the presence of this and another sulphur compound in coal gas, I did so in order that the public might be made aware of the fact, that all the coal gas of this metropolis invariably contains one of these impurities, and sometimes both of them; that by the combustion of these bodies an acid is generated which has the power of exerting a most destructive influence on goods of a perishable nature, and of producing injurious effects on the health and comfort of those who inhale it. To these remarks I added a suggestion, namely, 'That it is highly desirable, both for the sake of health and property, that some means should be taken to insure a more perfect manufacture of coal gas, and that every attention should be paid to ventilation, so as to carry off the noxious products generated during its combustion.' I intended that those remarks should be understood to apply to all the gas supplied to the metropolis, and not merely to that furnished by one particular company. In offering these remarks, I considered that I was acting in accordance with the intentions of my appointment, and guarding the public against the incalculable mischief which must of necessity arise from the operation of what to them is a hidden enemy. I venture, therefore, again to submit this matter to your consideration, for I believe that the valuable and economical application of gas to heating as well as to illuminating purposes, is only just beginning to be made available; and it appears to me to be of the greatest importance, both to the manufacturer of gas and the consumer thereof, that the products of its combustion should always be conveyed as speedily as possible into the open air. By directing attention to this precaution, I am quite sure that coal gas may be safely employed to any extent, either as a source of heat or light; and it is not too much to hope, that the time is not far distant when its applications will entirely supersede the use of coal, and so be the means of rendering the atmosphere of this metropolis as free from soot and smoke as is that of any city in the world. If, however, attention is not paid to so important a precaution, the mischief arising from the combustion of coal gas will prove an insuperable barrier to its employment for any other purpose than that of giving light. Already I perceive that a number of gas stoves have been introduced to the public, with the recommendation that they do not require a chimney, but may, like an ornament, be placed in any part of a room. In my opinion nothing can be more dangerous than such an insane application of so useful a material.—H. LETHEBY, M.D."

No stranger can visit London without remarking a total disregard of the advantages of gas-light in offices and private houses. When the subject is mentioned, the rash inquirer is immediately assailed with apocryphal traditions of the unpleasant heat and impure atmosphere of gas-lighted rooms—the believers in such abominations being quite forgetful or ignorant of the real state of matters. For example, a gentleman, perhaps, burns a couple or four mould candles in his dining-room; but being anxious to try gas-light, he puts in a couple of argand burners, each giving light equal to twelve or sixteen wax candles. He then, justly enough, complains of oppressive heat, a fault which he would find to be much more prominent if some thirty candles were employed as the source of light. It is quite true that London gas does contain some injurious impurities, but their effects have been greatly magnified, and, at any rate, an increase in domestic consumption would soon open up means for their removal.

PROVISIONAL PROTECTIONS FOR INVENTIONS

UNDER THE PATENT LAW AMENDMENT ACT.

☞ When the city or town is not mentioned, London is to be understood.

Recorded October 1, 1852.

1. Robert Adams, King William-street—Improvements in ball cartridges.
2. George H. Brockbank, Crawley-street, Oakley-square—Improvements in upright piano-fortes.
3. Peter Spence, Manchester—Improvements in obtaining power by steam.
4. James Hodgson, Liverpool—Improvements in constructing iron ships and vessels.
5. Joshua Smith, Sheffield—Improvements in table knives.
6. Moses Poole, Serle-street—Improvements in the manufacture of guns and pistols.
7. John H. Gardner, Poppin's-court—Improvements in toilet tables.
8. Richard Wright, Greenwich—Improvements in constructing vessels.
9. George Green, Mile-end-road—Improvements in the manufacture of casks.
10. Freeman Roe, Strand—Improvements in valves and cocks.
11. Thomas W. Gray, Commercial-road, Limehouse—Improvements in cocks and valves.
12. Thomas W. Gray, Commercial-road, Limehouse—Improvements in steam-engines.
13. Edward L. Hayward, Blackfriars-road—Improvements in lock spindles.
14. Thomas Christy, junior, Gracechurch-street—Improvements in weaving hat plush, and other piled fabrics.
15. Joseph Barker, Kennington-lane—Improvements in fastenings.
16. Moses Poole, Serle-street—Improvements in the manufacture of telescope and other tubes.
17. Charles H. Newton, 192 Camden-road-villas, and George L. Fuller, Peckham—Improvements in protecting electric telegraph wires.
18. Thomas D. Rotch, Furnival's-inn—Improvements in treating peat, and in manufacturing fuel and other products therefrom.
19. Moses Poole, Serle-street—Improvements in moulding articles, when india-rubber combined with other materials are employed.
20. Charles F. Bielefield, Strand—Improvements in constructing portable houses and buildings.
21. George Duncan and Arthur Hutton, Chelsea—Improvements in the manufacture of casks.
22. Henry W. Wood, Glamorgan—Improvements in the construction of ships and other vessels.
23. Jean B. Lavanchy, Richmond-buildings, Soho—Improvements in wind musical instruments where metal tongues are employed.
24. Moses Poole, Serle-street—Improvements in the making covers for, and in binding, books and portfolios, and in making frames for pictures and glasses.
25. John Macintosh, Berners-street—Improvements in regulating and governing the flow of fluids.
26. John Macintosh, Berners-street—Improvements in evaporation.
27. John Macintosh, Berners-street—Improvements in packing for steam-engines and other machinery.
28. Moses Poole, Serle-street—Improvements in coating metal and other substances with a material not hitherto used for such purposes.
29. John D. Ebingre, Brussels—Improvements in the manufacture of animal charcoal.
30. Moses Poole, Serle-street—Improvements in the manufacture of trunks, cartouch and other boxes, knapsacks, pistol holsters, dressing, writing, and other cases, and sword and other sheaths.
31. John D. Lee, Leadenhall-street—Improvements in covering railway trucks and other vehicles.
32. William P. Flynn, Cork—Improvements in paddle-wheels.
33. Moses Poole, Serle-street—Improvements in the manufacture of pails, tubs, baths, buckets, measures, drinking and other vessels, basins, pitchers, and jugs, by the application of a material not hitherto used in such manufactures.
34. Robert Beart, Godmanchester—Improvements in the manufacture of bricks, and other articles through moulding orifices.
35. Thomas Huckwale, Chipping-Norton—Improvements in instruments for administering medicine to horses and other animals.
36. James Hare, Birmingham—Improvements in expanding tables and in music stools.
37. Moses Poole, Serle-street—Improvements in covering and sheathing surfaces with a material not hitherto used for such purposes.
38. Hon. William E. Cochrane, Albany-street, Regent's-park—Improvements in unloading coals from ships or vessels.
39. Felix Abate, 21 George-street, Hampstead-road, and John J. C. de Clerville, Newman-street—Improvements in preparing, ornamenting, and printing on surfaces of metal and other substances.
40. Frederick R. Holl, Weymouth-terrace, City-road—Improvements in watches and chronometers.
41. Joseph Barrans, Queen's-road—Improvements in steam-engine boilers.
42. Oswald D. Hedley, Newcastle-upon-Tyne—Improvements in getting coal and other minerals.
43. Moses Poole, Serle-street—Improvements in harness, and in horse and carriage furniture.
44. James Hodgson, Liverpool—Improvements in machinery for draining land.
45. Charles W. R. Rickards, New-cut, Blackfriars-road—Improvements in tongs for screwing pipes and tubes.
46. James Stewart, Old St. Pancras-road—Improvements in the action of piano-fortes.
47. Stephen Perry, Red Lion-square—Improvements in inkstands or inkholders.
48. Edmund Morewood and George Rogers, Enfield—Improvements in rolling metal.
49. Edmund Morewood and George Rogers, Enfield—Improvements in coating metals.
50. Walter H. Tucker, Tiverton—Improvements in locks (applicable to locks for all purposes), by which they can be made so as to combine increased and perfect security with simplicity and cheapness of construction.
51. Thomas Craddock, Thames-bank—Improvements in the steam-engine and the steam-boiler.
52. Walter M'Lellan, Glasgow—Improvements in the manufacture of rivets and in working in metals.
53. Thomas B. Dalziel, Glasgow—Improvements in the treatment or manufacture of textile fabrics or materials.
54. George P. Renshaw, Nottingham—Improvements in turn-tables and traverse tables, and in apparatus connected therewith.
55. George Mumby, Harrington-street—Improvements in the manufacture of envelopes, and the machinery, apparatus, or means to be employed therein.
56. John Finlay, Glasgow—Improvements in grates and fire-places, or apparatus for the generation of heat.
57. John J. Macdonnell, Bristol—Improvements in the construction of railways.
58. William W. Sleigh, 1 Queen's-square, Bloomsbury—"The counteracting reaction motive power engine."
59. Marcus Davis, Strand—Improvements in the manufacture of carriages, carts, military and other waggons, and wheels for locomotive and other purposes.
60. William W. Bonney and Robert Archbutt, Chelsea—Improvements in machinery for raising a pile on linen, cotton, silk, or other fabrics.
61. John Baylis, 15 Owen's-row—Improvements in hat-bands and armlets.
62. John Sayers, 6 Prospect-place, Poplar—Improved arrangements for maintaining a level surface, or level surfaces, upon or in connection with bodies subject to a rocking motion.
63. John F. Stanford, Dover—Improved machinery and apparatus for manufacturing bricks, tiles, and similar building materials, which is hereby denominated "The Complete Brickmaker."
64. Henry R. Fanshawe, Old Kent-road—Improvements in shawls, scarfs, neckerchiefs, handkerchiefs, mantles, sails or sail-cloth, table-cloths and table-covers, napkins, and umbrella and parasol tops and covers, and an improved loom for weaving, applicable especially to the said improvements, in respect to some of the said articles.
65. James Stocken, Baldock—Improved plaster spatula.
66. George Holmes, Lincoln's-inn-fields—Improvements in the manufacture or construction of coats, capes, and other upper garments of personal attire.
67. James Brown, Canal-road, Mile-end—Improved method of making ships' or other vessels' anchors.
68. George Ellins, Droitwich—Improved method or apparatus for preparing flax straw for dressing and cleaning.
69. William Moore and William Harris, Birmingham—Improvement in repeating pistols and rifles.
70. Robert Lakin, Ardwick, and William H. Rhodes, Gorton—Improvements in machines for spinning and doubling cotton and other fibrous substances.
71. John A. Coffey, Providence-row, Finsbury—Improvements in apparatus for performing various chemical and pharmaceutical operations, hereby denominated "Coffey's improved patent Esculapian apparatus," parts whereof are applicable to steam boilers, steam and liquid guages, stills, and syphons.
72. Edward Wilkins, 60 Queen's-row, Walworth—Improvements in the distribution and application of water or other liquid manure to promote vegetation.
73. Edward Wilkins, 60 Queen's-row, Walworth—Improvements in ruling and folding the leaves of account-books or other books used for mercantile purposes, and in making entries therein, and delivering vouchers therefrom, with accuracy and despatch.
74. Christopher Kingsford, 18 Buckingham-street, Adelphi—Invention for machinery for solidifying peat, coal, and other substances of a like nature.
75. Laurentius M. Eller, Leadenhall-street—Apparatus to release or separate carriages on railroads in case of accident, giving at the same time a signal of distress.
76. Christopher J. Schofield, Cornbrook—Improvements in machinery or apparatus for cutting the pile of fustians and other fabrics.
77. Stephen Soulby, Ulverstone—Improvements in machinery for letterpress printing.
78. William Smith, Kettering—Improvements in machinery or apparatus for cleaning currants, raisins, and other fruits or vegetable substances.
79. Henry Smith, Stamford—Improvements in reaping-machines.
80. Matthias Walker, Horsham—Improved ashpan, or apparatus for taking up ashes and cinders, and separating or sifting them.
81. Frederick Osbourn, Albion-street, King's-cross—Machine or apparatus for facilitating the manufacture of various kinds of garments or wearing apparel.
82. Henry M. Ommanney, Chester—Improvements in certain parts of machinery for spinning cotton and other fibrous substances.
83. Henry M. Ommanney, Chester—Improved furnace for melting of metals in crucibles.
84. Edwin Pettitt, Kingsland—Improvements in the manufacture of ammoniacal salts and manures.
85. Joseph Brandeis, 92 Great Tower-street—Improvements in the manufacture of sugar and saccharine solutions.
86. David D. Kyle, 120 Albany-street, Regent's-park—Improved method of excavating and removing earth.
87. Robert R. Menzies, Glasgow—Improvements in the manufacture of carpets and other fabrics.
88. George Holcroft, Manchester—Improvements in steam-engines.
89. James N. Marshall, Bideford—Improved wheel for carriages and other vehicles.
90. John Aspinall, King William-street—Improvements in evaporating cane juice and other liquids, and in apparatus for that purpose.
91. William Walker, Liverpool—Improvements in wheels for railway carriages, and in the mode or modes of manufacturing the same.
92. Thomas Lawes, 32 City-road—Improvements in the manufacture of agricultural implements, or an improved agricultural implement.
93. Thomas Lawes, 32 City-road—Improved quilt or coverlet.
94. Thomas Lawes, 32 City-road—Improvements in generating steam.
95. William Oxley, Manchester—Improvements in apparatus for heating and drying.
96. Henry Bridson, Bolton-le-Moors—Improvements in machinery to facilitate the rinsing, washing, and cleansing of fabrics, which machinery is also applicable to certain operations in bleaching and dyeing.
97. John M. Dunlop, Manchester—Improvements in the manufacture of wheels for carriages.
98. Thomas Firth, Bradford—Improvements in machinery for preparing to be spun wool, mohair, flax, cotton, and other fibrous materials.
99. Robert A. Rlist, 320 Regent-street—Improvements in piano-fortes.
100. William Potts, Birmingham—Improvements in sepulchral monuments.
101. Thomas Allan, Adam-street—Improvements in the application of carbonic acid gas to motive purposes.
102. George Rennie, Holland-street, Blackfriars—Improved chain cable.
103. Charles Lungley, Poplar—Improvements in shipbuilding.
104. Martyn J. Roberts, Gerrard's-cross—Improvements in the manufacture of oxides of zinc and tin.
105. Richard A. Brooman, Fleet-street—Improvements in machines for cleaning knives.
106. Thomas Allan, Adam-street—Improvements in propelling.
107. Henry C. Hurry, Adam-street, Adelphi—Improved construction of fountain pen, or reservoir pen-holder.
108. Thomas Fearn, Birmingham—Improvements in ornamenting metallic surfaces, and in machinery and apparatus to be employed therein.
109. William Austin and William Sutherland, Birmingham—Improvements in ornamenting glass.
110. John Wright and Edwin Sturge, Lambeth—Improved machinery for the manufacture of envelopes.
111. John Remington, Chelsea, and Zephaniah D. Berry, Pimlico—Improvements in gas meters or apparatus for measuring gas or other elastic fluids.
112. Hermann Turck, Broad-street-buildings—Improvements in packing goods.
113. Bernhard Harczyk, St. Mark-street—Improved preparation or composition of colouring matter to be used in washing or bleaching linen and other washable fabrics, and in the manufacture of paper and other substances.
114. George Jenkins, Nassau-street—Improved means of obtaining motive power through an atmospheric engine, by facilitating the attainment of exhaustion by currents of caloric, the engine being worked by the pressure of the atmosphere.
115. Charles J. Carr, Derby—Improvements in machinery for making bricks and other similar articles.
116. William B. Davis, Southampton—Improvements in ships' buoys, life buoys, ships' fenders, and other similar articles.
117. John W. Fell, Glasgow—Improvements in prepaiing and spinning hemp and other fibrous materials, for the purpose of making ropes, twines, and other similar articles.

118. Alexander Stewart, Glasgow—Improvements in the manufacture or production of ornamental fabrics.
119. George Ennis, Jersey—Improvements in gaffs and booms.
120. George Collier, Halifax—Improvements in the manufacture of carpets and other fabrics.
121. John L. Stevens, Kennington—Improvements in furnaces.
122. Duncan Bruce, Canada—Improvements in rotatory steam-engines.
123. Richard Whytock, Libberton, Mid-Lothian—Improvements in the manufacture of fringes, and of pleat for these and other ornamental work.
124. Richard H. Heighway, New-road—Improvements in paving roads and other surfaces.
125. Thomas Hunt, Leman-street—Improvements in fire-arms.
126. George Bell, Wellington-street—Improvements in saturating canvas and other fabrics in order to render them buoyant and waterproof.
127. Robert W. Parker, Roxbury, U.S.—Improved mode of giving rotatory motion to a shaft of a circular saw, or other mechanical contrivance.
128. Wm. Rogers, 125 Long-acre—Improvements in studs, buttons, and other fasteners.
129. Joseph Cox, Heston—Improvements in the manufacture of gates and hurdles.
130. Isaac Westhorp, 9 George-yard—Improvements in grinding wheat and other grain.
135. Robert Griffiths, Great Ormond-street—Improvements in apparatus for indicating the number of persons entering, and the distance travelled in public or other conveyances and places, and for the prevention of fraud upon proprietors of public conveyances.
136. William G. Nixey, Moor-street—Improvements in tills and other receptacles for money.
137. Arthur Jackson, Liverpool—Improvements in gas-burners.
138. Richard A. Peacock, Lancaster—Improved construction of culvert for sewers for the purposes of drainage.
139. William Lewis, Piccadilly—Improvements in compounding medicines in the form of pills.
140. Thomas Robson, Woolwich-road—Improvements in apparatus for igniting signal and other lights.
141. Astley P. Price, Margate—Improvements in the manufacture of citric and tartaric acids, and of certain salts of potash, soda, ammonia, lime, and baryta.
142. Henry B. Barlow, Manchester—Improvements in the manufacture of cylinders for carding cotton and other fibrous substances.
143. John L. Gardner, Whitecross-street—Improvements in bottles and other vessels for holding liquids.
144. William Seaton, Coleshill-street, Pimlico—Improvements in the construction of iron vessels, and in sheathing or covering the same.
145. Donald Nicoll, Regent-street—Improvements in mourning bands for the arm or hat.
146. Edwin L. Brundage, Jewin-crescent—Improved machinery for forging nails, brads, and screw blanks.

Recorded October 2.

147. Edwin Whele, Shiffnall—Improvements in apparatus for burning candles, and in horological apparatus attached thereto.
148. Edward W. K. Turner, Praed-street, Paddington—Improvements in machinery for sweeping or cleaning chimneys; also for more effectually extinguishing them when on fire.
149. Edwin Whele, Shiffnall—Improved rotatory engine, to be worked by steam, air, or gases.
150. Thomas Boyd, Glasgow—Improvements in the treatment or finishing of woven fabrics.
151. David W. Sharp, Bingley—Improvements in machinery for combing and drawing a sliver of wool, flax, silk-waste, and other fibrous substances, and in apparatus for constructing screws to be used in a part or parts of such machinery.
152. Eugene De Varroc, Regent-street—Improvements in rendering glass reflective.
153. David S. Brown, Old Kent-road—Agricultural implement for tilling the soil.
154. David S. Brown, Old Kent-road—Obtaining useful products from sewers.
155. David S. Brown, Old Kent-road—Improved means of navigating the water by ships.
156. Joseph Brown, Leadenhall-street—Improvements in beds, sofas, chairs, and other articles of furniture, to render them more suitable for travelling, and other purposes.
157. James Mayelston, Elloughton—Improvements in the method of applying heat to the heating of water for feeding or supplying the boiler or boilers of steam-engines, or for other purposes.
158. Francis P. Walker, Manchester—Improvements in machinery for communicating signals to the drivers of railway engines.
159. Benjamin Fothergill, Manchester—Improvements in certain machinery for preparing to be spun, cotton, wool, flax, silk, and other fibrous substances.
160. Joseph Burch, Macclesfield—Improvements in building and propelling ships and vessels.
161. Richard A. Brooman, 166 Fleet-street—Improvements in purifying and disinfecting fats and fatty bodies, and in separating oleine from stearine.
162. John I. Fuchs, Zerbst, Duchy of Anhalt Dessau—An electro-magnetic apparatus.
163. Moses Poole, Serle-street—Improvements in the manufacture of tables, sofas, bedsteads, stands, chairs, and other articles of furniture, and the frames and bodies of musical instruments.
164. John R. Johnson, Hammersmith—Improvements in fixing colouring matter of madder in printing and dyeing.
165. Moses Poole, Serle-street—Improvements in constructing bridges, viaducts, and such like structures.
166. Samuel Powell, 52 Regent-street—Improvements in the manufacture of certain articles of wearing apparel.
167. Joseph Faulding, Edward-street, Hampstead-road—Improvements in machinery for sawing and cutting wood and other substances.
168. John Macintosh, Berners-street—Improvements in compositions to be used as paints.
169. Moses Poole, Serle-street—Improvements in machinery for mowing and reaping.
170. Edward Allport, Aldermanbury—Improvement in the manufacture of buttons, by making them with elastic shanks.
171. William J. Lewis, London, now residing at Turin, Sardinia—Slideless stadia sight, applicable to rifles and other fire-arms.
172. John Jobson, Litchurch—Improvements in manufacturing moulds for casting metal.
173. Theophilus Redwood, Montagu-street, Russell-square—Improvements in the manufacture of gelatine.
174. Alexander C. Duncan, Glasgow—Improvements in the art or process of dyeing cotton or other textile fabrics, or cotton or other yarns, when printed or mordanted with the colouring matter of madder or of dyewoods, and in machinery or apparatus employed therein.
175. Michael Cavanagh, Notting-hill—Improvements in mortice-lock spindles.
176. Peter H. Astley, Stratford, and John F. Stephens, De Beauvoir-square, Kingsland—Improved construction for floating vessels, having for its object the rendering them safe means of transit.
177. William Simpson and John S. Isaac, Maidstone—Improved composition, to be used principally as a substitute for wood or other materials, where strength and lightness are required in the manufacture of various articles.
178. William E. Newton, 66 Chancery-lane—Improvements in stoppers for bottles and other similar vessels.
179. Frederic Newton, Fleet-street—Improvements in the apparatus to be employed for producing photographic pictures.
180. John Slack, Manchester—Improvements in the manufacture of textile fabrics.
181. William E. Newton, 66 Chancery-lane—Improvements in governors or regulators for regulating the pressure of gas as it passes from the main or other pipes to the burners.
182. Samuel G. Archibald, Pall-mall—Improved mode of extracting or rendering animal fats and oils.
183. Thomas Green, jun., Westbourne-park-villas—Improvements in the construction of omnibuses.
184. Joseph Needham, 26 Piccadilly—Improvements in breech-loading fire-arms, and in apparatus connected therewith.
185. James E. MacConnell, Wolverton—Improvements in sheathing iron vessels, and in covering, lining, or coating sheets or other manufactured articles of iron or steel.
186. John Burnie, Castle Douglas—Improvements in cutting or reducing vegetable substances.
187. Alexander Miller, Glasgow—Improvements in the treatment or finish of textile fabrics and materials.
188. John Weems, Johnstone—Improvements in obtaining and applying motive power.
189. Alexander Willison, Ayr—Improvements in threshing machinery.
190. James A. Young, Glasgow—Improvements in dental operations, and in apparatus or instruments to be used therein.
191. John Stringfellow, Chard—Improvements in galvanic batteries for medical and other purposes.
192. George J. Philps, Friday-street—Improvements in hats and other like coverings for the head.
193. Ralph E. Ridley, Hexham—Improvements in cutting and reaping machines.
194. Thomas Lawrie, Glasgow—Improvements in forming and protecting inscriptions and devices in exposed situations.
195. George Stuart, Glasgow—Improvements in heating the fleeces of natural coverings of sheep and other animals when on the animals.

Recorded October 4.

197. John G. Marshall, Clifton-street—Improvements in rendering weather-tight doors, casements, and other similar openings.
199. Edwin Bates, 7 Great Portland-street—Improvements for deriving motive power from expansive fluids, and the better application and economy thereof for propelling ships and other vessels in sea, river, and canal navigation; also in the shape and action of wind sails, the use of water as a motive power for driving machines, mills, &c., the construction of turbines, air and water pumps, marine pumps for emptying ships of bilge water, and other useful purposes.
200. Edward Welch, 90 Oxford-terrace, Hyde-park—Improvements in fire-places and flues, and in apparatus connected therewith.
201. Martin Watts, Manchester—Improvements in machinery or apparatus for roving or preparing cotton and other fibrous substances for spinning.
202. William H. West, Blenheim-street, Oxford-street—Improvements in wind-guards and chimney-tops.
203. Robert Hazard, 14 Lincoln's-inn-fields—Calorific bath.
204. Bendix I. Jacoby, Hamburg—Improvements in the means of fixing artificial teeth.
205. Martin Billing, Holborn, and Charles H. Street, Birmingham—Improvements in the combination of metals, having different capacities of vibration, to be used in the construction of certain useful articles.
206. John Moseley, Birmingham—Improvements in machinery for cleansing linen and other fibrous materials.
207. William D. Napier, George-street, and William Lund, Cornhill—Improvements in apparatus for steering vessels.
208. Richard Manwaring and Thomas Hamblin, Maidstone—Improvements in ploughs.
209. James B. Storey, jun., Oakham—Improvements in mouth pieces for pipes and cigars.
210. Henry Webb and Joseph Froysell, Willenhall—Improvements in fastening knobs to doors and other locks.
211. Thomas Scott, 111 Drummond-street, Euston-square—Improvements in applying and transmitting motive power, and in accelerating the progress of bodies in motion.
212. Thomas Slater, New-road, St. Pancras, and Joseph J. W. Watson, Old Kent-road—Improvements in the application of electricity to illuminating purposes.
213. Antoine F. D'Henin, Belgium—Improvements in the treatment and manufacture of tobacco.
214. Thomas Kennedy, Kilmarnock—Improvements in obtaining and applying motive power, which improvements, or parts thereof, are applicable to timekeepers and clockwork, and for measuring and registering the flow of water and other fluids, and aeriform bodies.
215. John Erskine, Greenock—Improvements in the manufacture of felted and cemented fabrics.
216. Archd. Brown, Glasgow—Improvements in the construction of sheaves for blocks.

Recorded October 5.

217. Michael A. Garvey, Kentish-town—Invention for more effectually dissipating the shock of collision in railway trains, reducing the surfaces exposed to atmospheric resistance, and diminishing oscillation by making portions of the whole of each carriage elastic in every direction, and increasing the power of the carriage to resist severe pressure by means of metallic tubes in its longitudinal angles.
218. William Clark, Islington—Improvements in the construction of screw propellers for propelling vessels.
219. Arthur R. Burr, Halesowen—Improvements in making gun and pistol barrels, applicable to the manufacture of other kinds of tubes.
220. David S. Brown, Old Kent-road—Improved apparatus or instrument for evaporating or distilling liquids.
221. William Crosskill, Beverley—Improvements in machines for cutting or reaping growing corn, clover, and grass.
222. Aristide B. Berard, Paris—Improvements in the construction of jetties, breakwaters, and docks, and other hydraulic constructions.
223. John Houston, 45 Nelson-square—Improvements in obtaining motive power when air and steam are used conjointly.
224. John Houston, 45 Nelson-square—Improvements in metallic spring packings for pistons.
225. Joseph Apsey, Blackfriars—Improvements in shipbuilding and in machinery for propelling.
226. Diego Jimenez, Percy-street—Improvements in the manufacture of soap.
227. Benjamin Mitchell, Romsey—Improvements in the construction of artificial legs.
228. William E. Newton, 66 Chancery-lane—Improvements in machinery for boring or cutting rocks or other hard substances, for the purpose of tunnelling through mountains, or making other excavations.
229. William E. Newton, 66 Chancery-lane—Improvements in the means of producing a vacuum for various purposes, such as condensing steam, pumping water, exhausting air, or other purposes where a vacuum is required.
230. James Bullough, David Whittaker, and John Walmesley, Blackburn—Improvements in sizing machines.
231. George W. Nicholson, Pendleton—Improvements in screw-bolts, nuts, and washers, and in the machinery or apparatus for making the same.
232. John Prestwich the elder, Samuel Prestwich, and John Prestwich the younger, Tamworth—Improvements in machinery or apparatus for cleaning and finishing woven fabrics.

233. William Crook, Blackburn—Improvements in looms.
234. John Balmforth, William Balmforth, and Thomas Balmforth, Clayton—Improvements in steam boilers, and in fixing the same.
235. Adam and John Booth, Manchester—Improvements in platting or braiding machines, which machines are applicable to manufacturing webs for making door and other mats.
236. Robert Brown, Salford—Improved taking-up motion, applicable to looms, and other similar purposes.
237. Herm Jager, Ludgate-hill—Improvements in the treatment of cotton and other similar fabrics, by the introduction of chemical agents to supersede the use of dung in the dunging process.
238. William G. Elliott, Blisworth—Improvements in the manufacture of bricks, pipes, tiles, and other articles capable of being moulded.
239. Pierre F. Gougy, Castle-street, Leicester-square—Improvements in paving streets, roads, and ways.
240. Thomas Turnbull, Dundee—Improvements in the preparation and treatment of flax, hemp, and other similar vegetable fibres.
241. Jesse Ross, Keighley—Improvements in machinery or apparatus for combing wool, cotton, silk, flax, and other suitable fibrous materials.
242. William Mackenzie and George Blair, Glasgow—Improvements in the arrangement and construction of graduated scales for measuring instruments.
243. Samuel Getley, Birkenhead—Improvements in water-closets.
244. Joseph Westby, Nottingham—Improvements in machinery applicable to the manufacture of lace and other weavings.
245. William Dray, Swan-lane—Improvements in machinery for reaping and mowing.
246. George H. Cottam, Charles-street—Improvements in chairs, sofas, and bedsteads.
247. Christopher Nickels, York-street, Lambeth, and Frederick Thornton, Leicester—Improvements in weaving.
248. James Bird, 16 Orchard-street, Portman-square—New artificial manure.

Recorded October 6.

249. John Hughes, Carnarvonshire—Improved method of constructing roofs and sides of houses, buildings, and other structures.
250. William A. Gilbee, 4 South-street, Finsbury—Improved mode of disinfecting putrefied and fecal matters, and converting fecal matters into manure, also applicable to the disinfection of cesspools, drains, sewers, and other similar receptacles.
251. Auguste E. L. Bellford, 16 Castle-street, Holborn—Improvements in sewing machines.
252. Jacob T. Slade, Pall-mall—Improved mode of driving certain machines, and an improved driving-band or chain to be used therewith.
253. Charles de Bergue, Dowgate-hill—Certain improvements in machinery for punching metals, and for riveting together metallic plates or bars.
254. Robert Shaw, Portlaw, Waterford, Ireland,—Prearranging, ascertaining, and registering the rate of travelling of locomotive engines, and of railway and other carriages.
255. John Crooke, Manchester, and John W. Wood, of the same place—Certain improvements in the method of preserving hoop-iron from oxydation or decay.
256. John C. Jeffcott, 1 Anglesea-street, Cork—Invention for producing heat for generating steam, and applicable to and for other purposes for which this invention has not been hitherto used, under the name and title of a heat producer and steam generator.
257. Alexis Delemer, Radcliffe, Lancaster—Improvements in machinery or apparatus for manufacturing piled fabrics.
258. David Chambers, Manchester—Improvements in looms for weaving wire web or cloth by power.
259. George W. Nicholson, Pendleton—Improvements in vices, and in the means or method used for fixing the same.
260. William C. Fuller, Bucklersbury, and George M. Knevitt, New York, America, but now residing at Argyle-street, New-road—Certain improvements in applying india-rubber, or other similarly elastic substance, as springs for carriages.
261. William Abbot, Bideford—Improved plough.
262. Robert M. Glover, Newcastle-on-Tyne, and John Cail, of the same place—Improvements in miners' or safety lamps.
263. John G. Wells, Hartford, Connecticut, United States, but now of Trafalgar-square—Improved construction of self-inking stamping apparatus.
264. Alfred V. Newton, 66 Chancery-lane—Improvements in apparatus for manufacturing gas and coke.
265. David Collison, Preston—Improvements in the construction of shuttle skewers.
266. Henry A. Jowett and Frederick W. Jowett, Sawley—Improvements in apparatus for heating, which improvements are particularly applicable for generating steam or evaporating solutions, and may be applied for heating purposes generally.
267. Thomas B. W. Gale and Jonathan Fensom, Homerton—Improvements in the means of joining or coupling bands or straps.
268. William Crossby, Sheffield—Improvements in the ventilation of coal-pits and mines, ships' rooms, and buildings generally.
269. William V. Morgan, Jewin-crescent—Improvements in the preparation of oils for the purposes of illumination and lubricating machinery.
270. John Grimes, Coton House, Warwick—Atmospheric freezing machine.
271. Joseph Westby, Nottingham—Improvements in twist lace machinery.
272. Joseph Hill, Birmingham—Machine for stamping metals, and forging iron and steel.
273. John F. Chatwin, Birmingham—Improvements in the manufacture of brushes.
274. John F. Chatwin, Birmingham—Improvements in the manufacture of buttons.
275. Alphonse René le Mire de Normandy, Judd-street—Improvements in obtaining fresh water from salt water.
276. Francis Warren, 16 Millbank-street—Improvements in gas burners.
277. Admiral the Earl of Dundonald, Belgrave-road—Improvements in coating and insulating wire.
278. William Adolph, 9 Bury-court, St. Mary Axe—Improvements in apparatus for warming and ventilating rooms.
279. James Clark, Chapel House, Paisley—Improvements in weaving carpets and other fabrics, and in the machinery or apparatus employed therein.

Recorded October 7.

280. William Bissell, Wolverhampton—Improved cramp, or improved cramps, for cramping floors, doors, and joiners' and ship-work generally.
281. Samuel Perkes, 1 Walbrook—Certain improvements in the mode of treating skins, hides, leather, and other manufactured and raw productions.
282. John Blair, Ducie-bridge Mill, Manchester—Certain improvements in the manufacture of waddings, and in the machinery for making the same.
283. Thomas Greaves, Manchester—Improvements in the method or means of obtaining and employing motive power.
284. George Simpson, Manchester—Certain improvements in machines or apparatus for weighing.
285. Edwin Pettitt, Kingsland, and James Forsyth, Caldbeck—Improvements in spinning and drawing cotton and other fibrous substances, and in machinery for that purpose.
286. Auguste E. L. Bellford, 16 Castle-street, Holborn—Improvement in smoothing irons.
287. Auguste E. L. Bellford, 16 Castle-street, Holborn—Improvements in steam boilers.
288. Augustus Waller, London, but now residing at Bonn, on the Rhine, Prussia—Improvements in the means of measuring or ascertaining the quantity of alcohol and other substances in brandy, wine, beer, and other liquids.
289. John Tatham and David Cheetham, Rochdale—Improvements in rollers or bosses used for drawing or conveying textile materials and fabrics.
290. William Horsfield, Swillington Mills, Leeds—Improvements in splitting, crushing, and grinding corn, seeds, grain, minerals, or other substances.
291. Morris Lyons, Birmingham—Certain improvements in coating the surfaces of iron.
292. Samuel Rainbird, Norwich—Improvements in grappling and raising sunken vessels and other submerged bodies, and in apparatus for that purpose.
293. John Little, Glasgow—Improvements in ash-pans for fire-grates, stoves, and fire-places.
294. Mitchel Thomson, Plymouth—Improvements in lamps, and in the production of artificial light.
295. Peter Ward, Oldbury—Improvements in the manufacture of sal-ammoniac, and obtaining salts of ammonia.
296. Alfred Trueman, Swansea—Improvements in obtaining copper and other metals from ores or matters containing them.
297. Alfred Kent, Chichester—Improvements in glazing.

Recorded October 8.

298. Edward J. Hughes, Manchester—Improved method of purifying and concentrating the colouring matter of madder, munjeet, and spent madder.
299. Thomas Pascall, Norwood—Improvements in ridge tiles and roofing.
301. Samuel Smith, Swinton, near Manchester—Certain improvements in looms for weaving.
302. William Townley, 2 Bartlett's-buildings, Holborn-hill—Improved machinery or apparatus for watering and flushing streets, squares, courts, and other localities.
303. George Tillett, London—Certain improvements in bedsteads.
304. John Paterson, Wood-street—Improvements in buckles or fastenings.
305. John T. Tyler, Mount-street, Grosvenor-square—Improvements in hats, and in the preparation of plush or other covering used in the manufacture of hats.
306. John T. Tyler, Mount-street—Improvements in velouring machines, or machines used by hatters for causing the covering of hats to adhere to the body, and for polishing the nap of hats.
307. George Ennis, Jersey—Improvements in dredging machines.
308. John Lewthwaite, Halifax—Improvements in cards and tickets, and in machinery for cutting, printing, numbering, and marking cards, tickets, and paper.
309. James Yule, St. Luke's terrace, Gloucester—Improved arrangement of sawing machinery.
310. William E. Newton, 66 Chancery-lane—Improvements in the construction of hydraulic rams.

Recorded October 9.

311. Auguste E. L. Bellford, 16 Castle-street, Holborn—Improvements in apparatus for manufacturing soda-water and other aerated liquids.
312. James Bird, 16 Orchard-street, Portman-square—A new manufacture of cement.
313. John Egan, William-street, Limerick—A self-acting flax scutching and hackling machine, with horizontal blades or hackles; an incline plane, on which flax-holders move; the application of the fan by a current of air, to press flax against scutching-blades or hackles, and spring-catch flax-holders, as per drawing.
314. Richard Husband, Manchester—Certain improvements in weaving hat plush and other textile fabrics.
315. Alexander Clark, Gate-street, Lincoln's-inn-fields, and Patrick Clark, of the same place—Improvements in the manufacture of shutters, doors, and windows.
316. Antoine Burq, Paris—Certain instruments, apparatus, and articles for the application of electro, galvanic, and magnetic action for medical purposes.
317. William Scholfield and Joseph Pritchard, both of Oldham—Improvements in steam boilers.
318. William Maddick, Manchester—Improved method of extracting and concentrating, by evaporation, the colouring and other principles from all substances in which they are contained, and of thoroughly exhausting the same.
319. James Johnson, Worsley—Improvements in heating, ventilating, and sewering cottages or dwelling-houses.
320. John and William Smith, Manchester—Improvements in the method or process of dyeing woven or textile fabrics certain colours, and in machinery or apparatus employed therein.
321. Samuel Hardacre, Manchester—Improvements in machinery or apparatus for blowing, scutching, opening, cleaning, and sorting cotton, wool, and other fibrous substances, parts of which improvements are applicable to other purposes.
322. George Gent, Northampton, and Samuel Smith, of the same place—Fruit cleaning and dressing machine.
323. Jean Jemot Rousseau, Castle-street, Leicester-square—Improvements in inlaying and ornamenting metal plates, to be used for door plates, sign plates, and other purposes, to which such inlaid or ornamented plates may be applicable.
324. Thomas Restell, Strand—Certain improvements in chronometers, watches, and clocks, part of which improvements is applied to roasting-jacks.
325. John H. Johnson, 47 Lincoln's-inn-fields, and of Glasgow—Improvements in composing and distributing type.
326. Charles W. Siemens, Adelphi-terrace—Improvements in engines to be worked by steam and other fluids.
327. Jonas Lavater, 19 Rue Grenelle St. Honoré, Paris—Improvements in the apparatus for measuring the inclination of plane surfaces, and angles formed or to be formed thereon.
328. William Hine, Derby—Improvements in machinery applicable to paddle-wheels, windmills, and other useful purposes.

Recorded October 11.

329. Auguste E. L. Bellford, 16 Castle-street, Holborn—Improvements in the construction of revolving or repeating fire-arms.
330. Henry Moorhouse, Lancaster—Improvements in machinery or apparatus for cleaning woollen, cotton, or linen rags and waste, which machinery or apparatus is applicable to cleaning and tempering clay, or other similar purposes.
331. David Laidlaw, Glasgow—Improvements in the manufacture or production of gas burners.
333. George Searby, 9 Markham-street, Chelsea—Improvements in machinery for cutting, carving, and engraving wood, stone, metal, and other suitable materials.
334. George Searby, 9 Markham-street, Chelsea—Cure of smoky chimneys, and the prevention of the accumulation of soot in flues.
335. Robert Cochran, Glasgow—Improvements in kilns.
336. Charles M. Barker, 22 Portsmouth-place, Kennington-lane—Improvements in sawing wood.
337. Henry M'Farlane, 8 Lawrence-lane—Improvements in stoves or fire-places.
338. Robert Lambert, 13 Goree-piazza, Liverpool—Improvements in tents.
339. Andrew E. Brae, Leeds—Improvements in the means of, or apparatus for, exhibiting numbers, letters, dates, or other devices, for various purposes.
340. Henry Dewy, Taymouth-terrace, Philpot-street, Stepney—Improvements in disengaging ships' boats from their suspending chains or ropes.

Recorded October 12.

341. Edward Simons, Birmingham—Improvements in lamps.
342. François A. V. Michel, 19 Liecester square—Stereotyping in copper by the galvanoplasty.
343. John W. Couchman, 8 Princes-terrace, Pultney-street, Barnsbury-road—Closing and hanging of swing and other doors, by means of the spring and pivots.
344. Samuel Perkes, 1 Walbrook—Improvements in certain apparatuses and machines for the production and treatment of mineral and other substances, and part of which are applicable for other useful purposes.
345. Samuel Perkes, 1 Walbrook—Certain improvements in navigable vessels and propellers.
346. Samuel Perkes, 1 Walbrook—Certain improvements in mines, buildings, and sewerage for effecting sanatory purposes, and treating the produce therefrom.
347. Auguste E. L. Bellford, 16 Castle-street, Holborn—Improvements in sewing cloth and other materials.
348. Joseph Humphreys, Howard-street, Norfolk-street, Strand—Improvements in metallic and other designs for exhibition in or on shop and other windows and places.
349. Emanuel Wharton, Birmingham—Certain improvements in metallic bedsteads.
351. Louis C. A. Vittrant, Cambrai, France—Improvements in the preservation of vegetable and animal matters.
352. Thomas Dawson, Melton-street—Improvements in the means of cutting pile or terry fabrics.
353. Thomas Lacey, Grafton-street—Improvements in apparatus for raising liquids, and in joints for uniting india-rubber and other like flexible tubing.
354. Joseph Walker, Dover—Improvements in machinery for crushing and bruising malt, grain, and seeds.
355. Peter Warren, Strathmore-terrace—An improved material, applicable to many purposes for which papier-machée and gutta percha have been or may be used.
356. Joseph Robinson, Southampton—Improvements in ventilators.
357. Thomas B. Daft, Isle of Man—Improvements in inland conveyance.
358. William H. Smith, Montgomery, Pennsylvania, America—Improvements in the manufacture of lava ware.
359. Léon Godefroy, Paris,—Improvements in covering or packing rollers for printing fabrics.

Recorded October 13.

360. George Lloyd, Budbrooke—Improvement or improvements in the manufacture of paper.
361. Joseph P. Oates, Lichfield—Improved spring, or improved springs, for carriages.
362. William Tatham, Rochdale—Improved mode, or improved modes, of preventing accidents on railways.
363. John Carter, Meltham—Improvements in the manufacture of woven fabrics.
364. Matthew Smith, Over Darwen—Improvements in machinery for weaving and printing.
365. Edward Lloyd, Dee Valley, Merionethshire—Improvements in steam-engines, the whole or part of which improvements are applicable to other motive engines.
366. Joseph Nash, 3 Thames-parade, Pimlico—Invention of the treatment and refining of sugar.
367. Peter Armand Lecomte de Fontainemoreau, 4 South-street, Finsbury—A certain chemical combination for the silicatisation of calcareous matters.
368. William W. Stephens, Edinburgh—Application of retorts in gas ovens, or other ovens, to a process of improving iron, and converting iron into steel.
369. Thomas Suttie, Greenock—Improvements in roasting apparatus.
370. Robert Pinkney, Long-acre—Improvements in cases for holding marking materials.
371. Walter M'Farlane, Glasgow—Improvements in water-closets.
372. Richard Williams, Machen, Monmouth—Improvement or improvements in pumps or pumping.
373. Pierre J. R. Coquerelle, Paris—Combination of certain chemical agents for the replacing of indigo and other blues, which combination he calls "Rousset Blue."
374. Christopher Hill, Swindon—Improvements in the manufacture of lubricating matters.
375. Gerard A. Arney, Mitcham—Improvements in coating or enamelling pictures, prints, paper, and other surfaces.
376. Henry M'Farlane, Lawrence-lane—Improvements in constructing metal beams or girders.
377. Martyn J. Roberts, Gerrard's-cross—Improvements in galvanic batteries, and in obtaining chemical products therefrom.
378. Preston Lumb, Vauxhall—Improvements in apparatus for cleansing coal.
379. John H. Lee, 31 Northampton-square—Improvements in sawing.

Recorded October 14.

380. Alfred A. de R. Hely, Cannon-row—Improved waiter or tray.
381. Thomas Brown, Ebbw Vale Iron Works, Monmouthshire, and John Cox, Bristol—Improvements in the mode of heating retorts or ovens for the manufacture of gas, and other distillatory products of coal.
383. Donald Grant, Greenwich—Improvements in the means of applying the heat derived from the combustion of gas.
384. Joseph H. Tuck, Pall-mall—Improvements in stuffing-boxes, and in packing to be used in stuffing-boxes, bearings, pistons, and valves.
385. Louis Rossi, Regent-street—Improved manufacture of muffs, boas, tippets, and other like articles.
386. John Duncan, Dundee—Improvements in the treatment or manufacture of textile materials.
387. Joseph Major, 13 Elizabeth-place, Islington—Invention of removing spavins, ringbones, curbs, splents, and other unnatural ossifications and humours from horses, which invention he names "Major's Celebrated British Remedy."
388. Alsop Smith, Westminster—Improvements in the manufacture of firewood.
389. James Webster, Leicester—Improvements in the construction of springs.
390. John Swindells and William Nicholson, Manchester—Improvements in obtaining oxygen gas, and applying it in the manufacture of various acids and chlorine, for oxidating metallic solutions, and for ageing and raising various colouring matters.
391. Eugene A. Boutarel, Paris—Improvements in ornamenting or applying colour to fabrics.

Recorded October 15.

392. Joseph Burch, Macclesfield—Improvements in baths and bathing.
393. Joseph Burch, Macclesfield—Improvements in building ships and vessels for the purpose of saving lives and property in cases of shipwreck or fire at sea.
394. Robert H. Nicholls, Bedford—Invention for horse-hoeing land.
395. John Gedge, Strand—Improved stove, or heating apparatus.
396. James Lochhead, Kennington, and Robert Passenger, Southwark—Improvements in the manufacture of glass and other vitrified substances, and in ornamenting and annealing the same.
397. Henry Moseley, Wandsworth—Invention of a machine to be driven by the pressure of a fluid, or to displace a fluid, or to measure it.
398. Hermann Turck, Broad-street-buildings—Improvements in propelling vessels.
399. Joseph Hopkinson, yr., Huddersfield—Improvements in steam boilers.
400. Simon Pincoffs, Manchester, and Henry E. Schunck, Rochdale—Improvements in the treatment of madder, and other plants of the same species, and of their products, for the purpose of obtaining dyeing materials.
401. William E. Newton, 66 Chancery-lane—Improvements in washing and amalgamating gold and other metals.
402. John W. Branford, Rotherhithe—Improvements in fire-escapes.
403. Jeremiah Driver, Keighley, and John Wells, Bradford—Improvements in moulding in sand and loam, for the casting of iron and other metals.
404. William Stevenson, Preston—Improvements in weft forks for power looms.
405. Allan E. Hewson, Birmingham—Improved modes or processes for making buttons, beads, and other ornaments of dress.
406. Andrew Blair, Maryhill, Lanarkshire—Improvements in printing or ornamenting fabrics.
407. Charles H. Waring, Neath Abbey, Glamorganshire—Improvements in the cutting, and working, or quarrying, of coal, stone, shale, clay, and other similar substances, and in machinery for that purpose.

Recorded October 16.

408. William J. Matthias and Thomas Bailey, Clerkenwell—Improvements in clocks and watches.
409. Evan Leigh, Manchester—Improvements in machinery or apparatus for carding cotton and other fibrous materials.
410. Lot Faulkner, Cheadle—Improvements in the method of obtaining motive power.
411. Jerome A. Drieu, Manchester—Improvements in weaving cloth, to be employed in the manufacture of stays.
412. John Howard, Bolton—Improvements in the construction of steam boilers or steam generators.
413. Charles T. Judkins, Manchester—Improvements in machinery or apparatus for sewing or stitching.
414. John Woods, Rainhill—Improvements in screw stocks.
415. William B. Johnson, Manchester—Improvements in stationary steam-engines.
416. Isaac Atkin, Basford, and Charles Girling, Radford—Improved machine for the manufacture of looped fabrics.
417. Pierre A. Puis, Paris—Improved chain or cable, and an apparatus employed therewith for certain applications.
418. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in the manufacture of sugar.
419. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in the manufacture and applications of hyposulphite and similar compounds of zinc.
420. John O. York, Paris—Improvements in connecting and fixing rails in railway chairs.

Recorded October 18.

421. Charles Reeves, jun., Birmingham—Improvement or improvements in the manufacture of knives.
422. George R. Tovell, Mistley, and John Mann, jun., Colchester—Improvements in the construction of ships and other vessels.
423. Samuel F. Cottam, Manchester—Improvements in quarrying slate.
424. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in drying, and in the machinery or apparatus to be used therein.
427. Auguste E. L. Bellford, 16 Castle-street, Holborn—Improvements in the manufacture of fuel, part of which improvements are applicable to the manufacture of gas and soda, and freeing metals from extraneous substances.
428. John Campbell, Bowfield, Renfrew—Improvements in the treatment or finishing of textile fabrics and materials.
429. William Harcourt and Joseph Harcourt, Birmingham—Improvements in the construction and manufacture of match-boxes.
430. Richard A Brooman, 166 Fleet-street—Improvements in vices.
431. Henry Hughes and George Firmin, Plough-road, Rotherhithe—Improvements in the manufacture of lamp black, and in recovering from such manufacture a substance suitable for fuel.
432. Edwin Heywood, Glasburn—Improvements in looms.
433. John L. M'Leod, Marylebone Improvements in giving a metallic coating to iron ships' bottoms and other surfaces.

Recorded October 19.

434. Thomas W. Greathead, Holborn, James Hilliard, Cow-cross, and John G. Reynolds, City-basin, City-road—Improved means of heating, cooking, and warming.
435. John Goodman, Hazel-grove, Cheshire—Improved fountain pen.
436. Robert Mole, and Robert Mole, jun., Birmingham—Improvements in the manufacture of swords and matchets.
437. Arthur James, Redditch—Improvement or improvements in needle cases or wrappers.
438. Joseph Harcourt and William Harcourt, Birmingham—Application of porcelain, glass, or earthenware, to articles in which, or for which, those materials have never heretofore been used.
439. Martin W. O'Byrne and John Dowling, 17 Burr-street—Machine for cutting paper, millboard, leather, vellum, sheet metals, and other suitable materials for useful and ornamental purposes.
440. Fennell H. Allman, 16 Westbourne-street, Hyde-park—Improvements in the manufacture and construction of brushes.
441. John Kealy, Oxford-street—Improvements in machinery or apparatus for cutting or slicing roots.
442. William Newton, 66 Chancery-lane—Improved machine for separating ores, metals, and other heavy substances, from mud, sand, gravel, stones, and other impurities.
443. William Chisholm, Holloway—Improvements in obtaining caustic soda and other substances from the residues of articles used in the purification of gas.
444. Gabriel Benda, Basinghall-street—Improvements in apparatus for obtaining fire for smokers.
445. George Gotch, Islington—Improvements in transmitting intelligence upon railways.
446. Robert Bird, Crewkerne—Improvements in the straining webs of saddles.
447. George Gadd, Nottingham—Improvements in apparatus for roasting coffee.
448. James Otams, Camden-road—Improvements in the manufacture of manure.
449. John Jones, Sheffield—Improvements in handles for knives, razors, and other like instruments.

Recorded October 20.

450. George Heyes, Blackburn—Improvements in the manufacture of fancy woven or textile fabrics, and in the machinery or apparatus connected therewith.
451. Robert Brown, Manchester—Improvements in the method of ventilating buildings or apartments, and in the apparatus connected therewith.
452. John Carnaby, 130 St. John-street, Clerkenwell—Apparatus for turning, managing, and regulating the main taps of gas-pipes laid on to houses or buildings, at a part of the house or building distant from the main tap.
454. Charles Clarke, Brighton, and John Gilbert, 10 Hyde-place, Hoxton—Improvements in the supply and distribution of water and other fluids.
455. Auguste E. L. Bellford, 16 Castle-street, Holborn—Improvements in cocks or taps.
456. Anthony Liddell, Canterbury—Improvements in stuffing-boxes and in packing to be employed with stuffing-boxes and pistons.

457. Auguste E. L. Bellford, 16 Castle-street, Holborn—New mechanism to reverse the motion of steam-engines, particularly locomotives.
458. Peter E. Donaldson, Shrewsbury—Improvements in dams, locks, and lock-gates.
459. Charles W. Harrison and Joseph J. Harrison, Richmond—Improvements in protecting insulated telegraphic wires.
460. Gustave P. de Lhuynes, Conduit-street, Hanover-square—Improvements in apparatus for public announcements or advertisements.
461. Thomas H. Biddles and John W. Duphrate, Nottingham—Improvements in machinery for the manufacture of textile and looped fabrics.
462. Jacob T. Slade, Pall-mall—Improved hoisting apparatus.
463. William Harrison, Blackburn—Improvements in machinery or apparatus for sizeing, and otherwise preparing cotton, wool, flax, and other warps for weaving.
464. John Gilbert and Samuel Nye, 79 Wardour-street—Improvements in mincing meat and other substances.
465. Joseph Cundy, 21 Victoria-grove, Kensington—Improvements in hot-air stoves.
466. Robert Burns and Richard P. Willett, Liverpool—Improvements in machinery or apparatus for cutting bones.

Recorded October 21.

467. John Smith, Bilston—Machine for the cultivation or cleaning of land, and for digging potatoes or other roots.
468. Alexander Thomas, Peckham—Improvements in the treatment and welding of metals by certain chemical combinations.
469. Robert Hoppen, Plymouth—Improvements in apparatus for mincing meat.
470. William Lukyn the elder, Nottingham—Liquid draught detector, or self-measuring tube, with a union conveyance tap, and its stock and time table.
471. John Provis, Chippenham—Improvements in the construction of ships or vessels.
472. Joseph Rose, Aldersgate-street—Improvements in locks.
473. Julian Bernard, Guildford-street, Russell-square—Improvements in the production of ornamental surfaces upon leather.
474. William Weild, Manchester—Improvements in looms for weaving certain descriptions of pile fabrics.
475. John Currie, Glasgow—Improvements in grinding wheat and other substances, and in the treatment and preparation of such substances, and the products thereof.
476. Samuel Marsh, Mansfield—Improvements in the manufacture of woven fabrics by means of lace machinery.
477. Henry C. Gower, 9 Princes-street, Bedford-row—Improvements in the apparatus used in printing with colours.
478. Robert Chalker, 6 John-street, Adelphi—Improvements in the manufacture of manure.
479. William Addison, 5 Catherine-terrace, Old Ford—Improvements in constructing and propelling vessels.
480. John Fowler, Bristol—Improvements in machinery for draining land.
481. John Fowler, Bristol—Improvements in laying wires for electric telegraphs.
482. John Fowler, Bristol—Improvements in reaping machinery.
483. John Fowler, Bristol—Improvements in machinery for sowing seed and depositing manure.

Recorded October 21.

484. George Ellins, Droitwich—Improved method and apparatus for dressing and cleaning flax straw.
485. Jean M. Souchong, Paris—Improvements in the manufacture and purification of gas for illumination, and certain products therefrom, and in apparatus for that purpose.
486. Julien Boilesve, Brompton—Improved mode of preserving vegetable substances and animal coatings.
487. Archibald Slate, Dudley—Improvements in the manufacture and construction of cores and core bars, used in the production of hollow castings in iron and other metals.
488. Juliana Martin, Soho-square—Improved apparatus for artificial hatching.
489. Peter Armand Lecomte de Fontainemoreau, 4 South-street, Finsbury—Improvements in apparatus for essaying silk, cotton, and other similar fibrous substances.
490. Stanislaus Hoga, Nassau-street—Improvements in separating gold from the ore.
491. James Wilson, 37 Walbrook—Improvements in printing fabrics of silk, or partly of silk.

Recorded October 22.

492. John Holmes, Manchester—Improvements in lathes.
493. George Price, Birmingham—Improved gas stove.
494. Philip Berry, Manchester—Improvements in machinery or apparatus for manufacturing bolts and nuts, and other similar articles in metal.
495. David Crichton, Manchester—Arrangements and apparatus for producing continuous circular motion, giving a series of different velocities obtained from alternate motions, applicable to looms and other machines.
496. Thomas Fothergill and Alexander C. Harvey, Manchester—Improvements in the treatment of cotton wool, and in the manufacture of coloured yarns or threads therefrom.
497. Louis N. Legras, Wenlock-street, Hoxton, and William L. Gilpin, Bayswater—Improvements in the generation of electricity.
498. George Malcolm, Dundee—Improvements in the process of carding or teasing jute and other fibrous substances.
499. James Brodie, Fife—Improvements in the construction of sea-going vessels.
500. Arnold J. Cooley, Parliament-street—Improvements in the manufacture of artificial leather.
501. Louis N. Legras, Wenlock-street, Hoxton, and William L. Gilpin, Bayswater—Improvements in treating flax, hemp, and other fibrous substances.
502. Charles W. Graham, Bishopsgate-street Within—Improvements in the manufacture of bottles and jars.
503. Albert Hiscock, Tichbourne-street, Haymarket—Application of ornamental printing to certain fabrics, which have hitherto not been printed upon.
504. George K. Geyelin, Camden-town—Improved machine for grinding pigments or other vegetable or mineral substances.
505. William Macbay, Woolwich—Improvements in extinguishing fire in dwellings, factories, and other buildings, and in ships.
506. Robert M. Marchant, Pimlico—Improvements in the construction of bridges.
507. Felix L. Bauwens, Croydon—Improvements in treating fatty matters prior to their being manufactured into candles and mortars, which are also applicable to oils.
508. William White, Cheapside—Improved fabric, suitable for ventilating hat bodies.
509. Charles Watson, Halifax—Improvements in ventilation.
510. James Tayler and James Slater, Manchester—Improvements in machinery, apparatus, or implements for weaving.

Recorded October 25.

511. John Hunter, Liverpool—Improvements in electric telegraphs, and in apparatus connected therewith.
512. John J. Stoll, Enfield—Improvements in the manufacture of boots and shoes, and similar articles, and in machinery used therein, entitled "metallic toothed and wedged seams and waterproof elastic indented stitches."
513. Samuel Plimsoll, Sheffield—Invention of more thoroughly and effectually cleansing, extracting, and separating, or fining ale, beer, porter, bitter beer, India pale ale, and other malt liquors from the yeast, bottoms, barm, sediment, and other extraneous matters and impurities with which it may be in combination.
514. Charles L. Desbordes, Paris—Improvements in instruments for measuring the pressure and temperature of air, steam, and other fluids.
515. Robert W. Mitcheson, Garford-street—Improvements in anchors.
516. Arthur Wall, Poplar—Improvements in the manufacture of sulphuric and other acids.
517. Joseph F. A. Debray, Paris—Improved stock or neckcloth.
518. William Johnson, 47 Lincoln's-inn-fields, and of Glasgow—Improvements in the manufacture of spikes or metal pins.
519. Mathew Fitzpatrick, Upper Cleveland-street—Improvements in machinery or apparatus to be applied to locomotive engines and carriages for the prevention of accidents, and also in the manufacture and application of indestructible non-rebounding cushions, to be applied to the above, and for other similar purposes.

Recorded October 26.

520. Claude M. A. Marion, Paris, now residing in Regent-street—Invention of a new kind of damper for moistening stamps and paper.
521. John Cass, Blue-pits, near Rochdale—Improvements in steam-engines.
522. William Smith and John Smith, 5 Upper John-street—Improvements in garments or articles of dress.
523. William Clarke, Manchester—Improvements in joints for connecting metals.
524. Charles Rowley, Birmingham—Improvements in nails.
525. Myer Myers and Maurice Myers, and William Hill, Birmingham—Improvements in pens and penholders.
526. James Nasmyth, Stafford-street—Improved mode of utilizing running waters.
527. Joseph Charles Frederick Baron de Kleinsorgen—Improved apparatus for indicating the variation of the magnetic needle.
529. Robert W. Mitcheson, Garford-street—Improved safety-hook.
530. Henry Page, Whitechapel-road—Improvements in paper-staining.
531. George Evans, Marylebone—Improvements in treating peat and other carbonaceous matters.
532. John L. Stevens, Kennington—Improvements in furnaces.
533. Anthony F. Bainbridge, Putney—Improvements in the manufacture of artificial flies and other bait for fish.
534. Samuel Clarke, 55 Albany-street, Regent's-park—Improvements in the manufacture of candles.
535. James Conry, Manchester—Improvements in umbrellas and parasols.
536. James Crosby, Manchester—Improvements in looms.
537. William R. Bertolacci, Paris—Improved pneumatic ink and pen holder.
538. Alfred C. Hervier, Paris, South-street, Finsbury—Improvement in the application of centrifugal force to propelling on water.
539. Louis N. Legras, Hoxton, and William L. Gilpin, Bayswater—Invention of a compound having the properties of gutta percha.
541. Thomas W. Lord, Leeds—Improvements in safety and other lamps
542. Henry Carr, East Retford—Improvements in railways.
543. John Norton, Cork—Improvements in blasting.
544. James H. Young, Camden-town—Improvements in expressing juice or fluid from the sugar cane, and from other matters.
545. Charles B. Normand, Havre—Improvements in machinery for sawing wood.
546. James Nasmyth, Stafford-street, Bond-street—Improvements in the mode of obtaining and applying motive power.
547. James H. Smith, Connaught-terrace—Improvements in corsets.

Recorded October 28.

548. William Thorp, Collyhurst—Improvements in steam-boxes, and the mode of heating press-plates used in hot-pressing of silks, de laines, cobourgs, merinos, fancy goods, and other similar fabrics.
549. Bryan Donkin the younger, Bermondsey, and Barnard W. Farey, Old Kent-road—Improvements in the machinery for measuring or marking off long lengths or continuous webs of paper or other materials into any required lengths, for the purpose of being cut or otherwise disposed of.
550. John Wormald, Manchester—Improvements in machinery or apparatus for roving, spinning, and doubling cotton, wool, or other fibrous substances.
551. Henry Provost, Paris—Improved hat protector.
552. George Hattersley, Sheffield—Invention of a radiating hearth plate.
553. Charles F. Bielefeld, Strand—Improvements in billiard and bagatelle tables.
554. John C. Browne, Chatham—Invention of the relief of individuals suffering from pulmonary affections or diseases of the chest.
555. Thomas P. Tabberer, Derby—Improvements in machinery for framework knitting.
556. Charles A. Redl, Davis-street, Berkeley-square—Improvements in telegraphing or communicating signals at sea and otherwise.
557. Robert Mallet, Dublin—Improvements in fire-proof and other buildings and structures.

Recorded October 29.

558. Henry R. Ramsbotham and William Brown, Bradford—Improvements in preparing and combing wool and other fibrous substances.
559. Charles A. Joubert, Léon Jacques Tricas, and Jules César Kohler, Paris—Improved busks for stays.
560. Arthur Ashpitel and John Whichcord the younger, Regent-street—Improvements in cocks, valves, and fire-plugs.
561. James G. Wilson, Chelsea—Improvements in signals to be used on railways, or for similar purposes, and in the apparatus connected therewith.
562. Arnold J. Cooley, Parliament-street—Improvements in treating woven and felted fabrics, to render the same repellent to water and damp.
563. George Bower, St. Neot's—Improvements in gas stoves or fire-places.
564. William Bates, Leicester—Improvements in apparatus for getting up stockings and other hosiery goods.
565. William H. F. Talbot, Lacock-abbey, Wilts—Improvements in the art of engraving.
566. Louis N. Le Gras, Wenlock-street, City-road, and William L. Gilpin, Bayswater—Improvements in transmitting electric currents.
567. Richard A. Brooman, Fleet-street—Improvements in violins and other similar stringed musical instruments.
568. Richard A. Brooman, Fleet-street—Improvements in tackle blocks.

Recorded October 30.

569. William Binns, Trinity-square—Improved mode of constructing a draught breast-plate or collar for horses or other draught animals.
570. Martin Watts, Patricroft, near Manchester—Improvements in machinery or apparatus for roving or preparing cotton and other fibrous substances for spinning.
573. Edward Bird, Birmingham, and Edward Welch, London—Improved cart or vehicle.
574. John Gedge, Wellington-street, Strand—Improvements in printing presses or machines.
575. Pierre B. de Lucenay, Paris, and South-street, Finsbury—Production of photographic images by means of artificial light.
576. Bowman F. M'Callum, Glasgow—Invention of a yarn drying-machine.

577. John Crowther, Huddersfield, and William Teall, Wakefield—Improvements in obtaining motive power.
578. Edmund A. Kirby, Haverstock-hill—Improved adjusting couch for medical, surgical, and general purposes.
579. Alfred V. Newton, Chancery-lane—Improvements in machinery for cutting corn and other standing crops.
580. Jean Auguste Lebrun, Panton-square—Improvements in the construction of buildings and pavements, and the manufacture of the materials used therein.
581. Julian Bernard, Guildford-street, Russell-square—Improvements in the manufacture of glass.
582. James Sinclair, Stirling—Improvements in engines to be worked by steam, air, or water, the said improvements being also applicable to pumps.
583. Richard A. Brooman, Fleet-street—Improvements in revolving fire-arms.
584. George T. Selby, Birmingham—Improvements in steam boilers.
586. George T. Selby, Birmingham—Improvements in machinery for the manufacture of tubes and pipes.
588. George F. Wilson, Vauxhall, and Edward Partridge, Wandsworth—Improvements in the instruments or apparatus used when burning candles.
589. William Dantec, Liverpool—Improvements in preventing incrustation in steam boilers.

Recorded November 1.

590. William Petrie, Woolwich—Improvements in the manufacture of sulphuric acid.
591. George Evans, Wellington—Improved gridiron.
592. George Dixon, Dublin—Improvement in bleaching palm oil.
593. Edward Lawson, Leeds—Improvements in machinery for preparing to be spun, hemp, flax, tow, wool, silk, cotton, and other fibrous materials.
594. Charles J. Berkeley, Smethwick—New or improved reflector, or new or improved reflectors, for illuminating purposes.
595. Joseph J. W. Watson, Kent-road, and Thomas Slater, St. Pancras—Improvements in galvanic batteries, and in the application of electric currents to the production of electrical illumination and of heat, and in the production of chemical products by the aforesaid improvements in galvanic batteries.
596. Joseph Dunning, Regent-street—Improvement in the construction of coke ovens.
597. Henry Walker, Gresham-street West—Improvements in machinery and apparatus used in cylinder printing.
598. Henry B. Billows, Curtain-road—Improvements in the construction of gas burners for illuminating and heating purposes.
599. Julius Smith, Islington—Improvements in apparatus to be used in ships and steamers for ascertaining and signalling depths at sea.
600. George F. Wilson, Vauxhall—Improvements in the manufacture and treatment of oils.
601. Julius Jeffreys, Croydon—Improvements in obtaining power when steam or other vapour is used.
602. John Chubb, St. Paul's Churchyard—Improvements in locks.
603. David Thomson, Dundee—Improvements in the manufacture of carpets.
604. Paul Jerrard, Fleet-street—Improvements in ornamenting japanned and papier-machée surfaces, as also the surfaces of varnished and polished woods.
605. George Stenson, Northampton—Improvements in apparatus for separating gold from auriferous sand and earth.
606. John Jaques, younger, Hatton-garden—Improvements in chess and draught boards.
607. Francis Daniell, Camborne, Cornwall—Improvements in stamp heads.

Recorded November 2.

608. Jerome A. Drieu, Manchester—Improvements in machinery for weaving and for dividing double cloth to make pile fabrics.
609. John N. Marion, Paris, and South-street, Finsbury—New mode of rendering concrete coleseed oil.
610. William E. Newton, Chancery-lane—Improvements in the manufacture of capsules or covers for bottles, and other hollow articles.
611. Robert W. Slevier, Holloway—Improvements applicable to the manufacture of hats, caps, and bonnets, or other coverings for the head.
612. James Dible, Northam—Improvements in ventilating and heating ships, which improvements are also applicable to extinguishing fire on board ship.
614. Charles D. Archibald, Rusland Hall, Milnthorpe—Improvements in lighting and heating.
616. Louis A. Pouget, Paris—Improvements in lamps.
617. John Macintosh, Aberdeen—Improvements in the manufacture of paper.
618. Georges H. Ozouf, Paris—Improvements in working, forming, or shaping sheet metal and alloys.
619. George F. Wilson, Belmont, Vauxhall—Improvements in the preparation of materials for, and in the manufacture of, candles and night lights.
620. George F. Wilson, Belmont, Vauxhall—Improvements in treating wool in the manufacture of woollen and other fabrics.
621. Bernhard Samuelson, Banbury—Improvements in breaking up and tilling land.

Recorded November 3.

622. George W. Ley, Grand Parade House, Brighton—Manufacture of a material to be used for certain purposes instead of wood, leather, millboard, or oil-cloth.
624. Edward Lord, Todmorden—Improvements in certain machinery to be used in preparing, spinning, and weaving cotton and other fibrous substances.
625. John Cameron, Manchester—Improvements in boilers for generating steam, and in feed-pumps and apparatus connected therewith.
626. Charles Phillips, Bristol—Improvements in apparatus or machinery for reaping or cutting crops of corn, or other crops, to the cutting of which reaping machines are applicable.
627. Alfred A. de Reginald Hely, Cannon-row—Improved shade or chimney for lamps, chandeliers, gas, and other burners.
628. Alfred Sidebottom, Downham-road, Islington—Improvements in machinery or apparatus for cutting books, paper, and other substances.
629. Auguste A. Tiesset, Boulogne-sur-Mer, France—Improvements in apparatus for exhibiting notices and advertisements of various kinds.
630. Henry Spencer, Rochdale, and Edmund Taylor, of the same place—Improvements in steam-engines and boilers.
631. Harrison Blair, Colthurst—Improvements in apparatus for supplying steam boilers with water.
632. Nehemiah Hodge, North Adams, Massachusetts, United States—Invention for discharging water from the hold of a navigable vessel.
633. John Macintosh, Berners-street—Improvements in projectiles and cartridges.

Recorded November 4.

634. Emily Pettit, 10 Brompton-crescent, Brompton—Musical instrument, which she calls a "Euphotine."
635. Charles Pryse and Richard Redman, both of Birmingham—Improvements in a certain description of fire-arms.
636. Elisha T. Archer, Oxford-street—Improvements in the manufacture of coverings for walls.
637. William Pope, Holford-square, Pentonville—Improvements in the ventilation of ships.
638. Augustus Brackenbury, 49 Henry-street, St. John's Wood, Paddington—Precipitating the muriate of soda more economically than the process now adopted.
639. Joseph Reynaud, Paris—Certain improved means of imitating marbles and various coloured woods.

Enrolled November 5.

641. Collinson Hall, Essex—Apparatus to be used in the carriage of solid and liquid bodies.
642. James Pilbrow, Tottenham—Certain improvements in obtaining motive power.
643. Joseph Bunnett, Deptford—Improvements in revolving iron or other metal shutters.
644. George Shand, Glasgow, and Andrew M'Lean, Edinburgh—Improvements in obtaining products from tar.
645. Peter Fairbairn, Leeds—Certain improvements in self-acting reeling machinery for reeling flax and other yarns into hanks.
646. George Fife, Newcastle-upon-Tyne—Improvements in steam and water guages.
647. John H. Porter, Birmingham—Improvements in the construction of portable buildings and other structures.
648. John Frame, Glasgow—Improvements in looms for weaving.
649. Andrew L. Knox, Glasgow—Improvements in the manufacture or production of ornamental fabrics.
650. James Wotherspoon, Glasgow—Improvements in the manufacture or production of confectionery, and in the machinery, apparatus, or means employed therein.
651. Hesketh Hughes and William T. Denham, both of Cottage-place, City-road—Certain machinery for the manufacture of fancy ribbons, ornamental trimmings, chenilles, fringes, and gimps.
652. James H. Young, 66 College-street, Camden-town—Improvements in weaving.
653. Charles Hampton, 61 Berwick-street, St. James—Improvements in piano-fortes.
654. Richard Wright, Greenwich—Improvements in shafts and plummer blocks.
655. Robert B. Cousens, 50 Halliford-street—Improvements in machinery for cutting cork.
656. Admiral the Earl of Dundonald, Belgrave-road—Improving bituminous substances, thereby rendering them available for purposes to which they never heretofore have been successfully applied.

Recorded November 6.

657. John Melville, Porchester-terrace—Improvements in the application of iron, and of wood combined with iron or other substances, to buildings and other constructions.
658. John R. Corry and James B. Corry, Queen Camel—New method of sewing gloves.
659. John, Edward, and Charles Gosnell, 12 Three King-court, Lombard-street—Certain improvements in brushes.
660. James Nichol, Edinburgh—Certain improvements in the process of graining or ornamenting surfaces and fabrics.
661. Francis B. Frith, Salford—Certain improvements in machinery or apparatus for dressing, machining, and finishing velvets, velveteens, cords, beaverteens, and other descriptions of fustian goods.
662. Peter Fairbairn, Leeds, and John Hargrave, Kirkstall—Certain improvements in machinery for opening, combing, and drawing wool, flax, and other fibrous materials.
663. Joseph V. Augier, Rue de Chabrol, 39, Paris—Improvements in the manufacture of gas, and in the machinery or apparatus employed therein.
664. John A. Phillips, 8 Upper Stamford-street, Blackfriars—Improvements in purifying tin.
665. Thomas H. Chandler, Aldbourn—Improvements in hoes.
666. Benjamin Baillie, 118 Wardour-street, Soho—Improvements in apparatus for drawing off and registering the flow of fluids.
667. William F. de la Rue, Bunhill-row, and George Waterston, Edinburgh—Improvements in writing-cases.
668. Charles F. Day, Ashford, Kent, and John Laylee, Rye, Sussex—Certain improvements in sleepers and other parts of the permanent ways of railroads.
669. Jacques Morel, Lyons, France—Improvements in figure weaving.

Recorded November 8.

670. Charles Troupeau, Paris—Improved diurnal reflector.
671. George J. Walker, Norton Folgate—Improvements in gigs and other carriages.
672. Stephen Carey, Great Guildford-street—Improvements in the construction of viaducts, arches, bridges, and other buildings upon a non-expansion principle.
673. James Brodie, Bow of Fife—Improvements in the propulsion of sea going vessels.
674. Peter Fairbairn, Leeds—Improvements in the ordinary screw gill machinery, when applied to the purposes of drawing, combing, and heckling fibrous materials.
675. Jonathan S. Crowley, Lavender-hill, Surrey—Improvements in the means of, or apparatus for, working the signals and switches on railways.
676. William E. Newton, Chancery-lane—Improvements in the manufacture of the carbonates of soda.
677. Andrew Robeson, jun., Rhode Island, U. S.—Improved mode of bowking or bucking cloth.
678. Robert I. Longbottom, Regent-street—Improvements in preventing vibration in railway and other carriages, and in axles.
679. Stanislaus Hoga, Nassau-street—Instrument for ascertaining the existence of gold in the earth.

Recorded November 9.

681. James A. Heathcote, Hackney—Improvements in the mode of exhausting siphons or pipes for drawing off fluids.
682. Mark Newton, Tottenham—Improvements in the construction of carriages, and in the means of preventing the overturning of the same when horses take fright.
683. Jean J. Ziegler, Guebwiller, in the Department of Haut Rhin, France—Improvements in machinery for preparing to be spun, cotton, wool, silk, silk waste, flax, tow, and other fibrous substances.
685. Robert Knowles, Chorlton-upon-Medlock—Improvements in boilers and apparatus for generating steam.
686. Nelson M'Carthy, Cork—Improvements in boots and shoes.
687. Alfred Waterhouse, St. Paul's Churchyard—Improved filtering-pot.
688. George S. Ogilvie, Stapleton—Improvements in candlesticks and lamps.
689. Thomas Revis, Stockwell—Improved single seed drilling or dibbling machinery.
690. James C. Booth, Philadelphia—Manufacturing chromate and bi-chromate of potash from chromic iron or chrome ore.
691. William Gossage, Widnes—Improvements in obtaining sulphur from certain metallic sulphurets.
692. William E. Newton, 66 Chancery-lane—Improvements in the construction of axles or axletrees.
693. William T. Mabley, Manchester—Improvements in ornamenting glass and other transparent, or partially transparent, substances for windows, and for other purposes.
694. Charles Griffin, Leamington Spa—Improvements in apparatus for fixing type or printing surfaces in a chase.
695. Robert B. Evans, Colyton—Improvements in the manufacture of charcoal.
696. John D. Gordon, Eldon-street, Finsbury—Improvements in tuning piano-fortes.
697. Obed Hussey, Manchester—Improvements in reaping-machines.
698. Oswald D. Hedley, Newcastle-upon-Tyne—Improvements in getting coals and other minerals.

Recorded November 10.

699. Charles Fox, Scarborough—Improvements in the extraction or rendering of oil from fatty or oleaginous matters.

701. John G. Guinness, Lisson-grove—Improved mode of heating by air.

703. Auguste Baboneau, Paris—Improved apparatus for melting and mixing asphalte with bitumen and other substances.

☞ *Information as to any of these applications, and their progress, may be had on application to the Editor of this Journal.*

ENGLISH PATENTS.

Sealed from 18th October, to 13th November, 1852.

William Brown, Heaton, near Bradford, York, mechanist,—"Certain improvements in machinery and apparatus for preparing and spinning wool, hair, flax, silk, and all other fibrous materials."—October 18th.

Alfred Vincent Newton, Chancery-lane, Middlesex, mechanical draughtsman,—"An improved mode of manufacturing railway chairs."—(Communication.)—19th.

Joseph Palin, Liverpool, Lancaster, wholesale druggist, and Robert William Sievier, Upper Holloway, Middlesex,—"Improvements in brewing; and also in the production of extracts or infusions for other purposes."—19th.

William Edward Newton, Chancery-lane, Middlesex, civil engineer,—"Improvements in machinery or apparatus for sewing."—(Communication.)—19th.

William Edward Newton, Chancery-lane, Middlesex, civil engineer,—"Improvements in machinery or apparatus applicable to public carriages, for ascertaining and registering the number of passengers who have travelled therein during a given period, and the distance each passenger has travelled."—(Communication.)—19th.

Edward Henry Jackson, Titchfield-street, Soho, Middlesex, machinist,—"Certain improvements in producing artificial light, and also in producing motive power."—21st.

Edward Brailsford Bright, Liverpool, Secretary to the English and Irish Magnetic Telegraph Company; and Charles Tilston Bright, Manchester, telegraphic engineer,—"Improvements in making telegraphic communications, and in instruments and apparatus employed therein and connected therewith."—21st.

William Reid, University-street, electric telegraph engineer,—"Improvements in electric telegraphs."—21st.

William Boggett, St. Martin's-lane, Westminster, gentleman, and George Brooks Pettit, Lisle-street, Westminster, gas engineers,—"Improvements in obtaining and applying heat and light."—21st.

John Charles Wilson, Redford Flax Factory, Thornton, near Kirkcaldy, Fifeshire civil engineer,"—Improvements in the machinery and processes employed in and for the manufacture of flax and other fibrous vegetable substances."—21st.

Robert M'Gavin, Glasgow, Lanarkshire, merchant,—"Improvements in the manufacture of iron for ship-building."—23d.

Henry Needham Scrope Shrapnel, Gosport,—"Improvements in extracting gold and other metals from mineral and earthy substances."—23d.

James Lamb, Kingsland, Middlesex, gentleman, and Joseph Menday, of the same place engineer,—"Improvements in the construction of kilns for burning or calcining cement, chalk, limestone, and other substances requiring such process, and in the application of the heat arising therefrom to the generation of steam."—23d.

Joseph Walker, Dover, Kent, merchant,—"Improvements in treating cotton seeds, in obtaining products therefrom, and in the processes and machinery employed therein, parts of which improvements are applicable to distillation."—(Communication.)—Nov. 2d.

Patrick M'Anaspie, Liverpool, gentleman,—"A new manufacture of Portland stone cement and other compositions, for general building purposes and hydraulic works."—2d.

John Crowther, Huddersfield, York,—"A self-acting hydraulic crane or engine for lifting weights, such weights when lifted to be used as motive power; as also for loading and unloading vessels and vehicles."—2d.

Louis Arnier, Rue du Loisir, Marseilles, France, engineer,—"Certain improvements in steam boilers."—6th.

Pierre Armand Lecomte de Fontainemoreau, South-street, Finsbury, English and Foreign patent agent,—"Certain improvements in the manufacture of certain articles of dress."—(Communication.)—6th.

Charles Liddell, Abingdon-street, Westminster, Esq.,—"Improvements in electric telegraphs."—11th.

John Weems, Johnstone, Renfrew, North Britain,—"Improvements in the manufacture or production of metallic pipes and sheets."—11th.

Andrew Fulton, Glasgow, Lanark, North Britain, hatter,—"Improvements in hats and other coverings for the head."—11th.

William Petrie, Woolwich, Kent, civil engineer,—"Improvements in obtaining and applying electric currents, and in the apparatus employed therein; part or parts of which improvements are applicable to the refining of certain metals, and to the production of metallic solutions, and of certain acids."—13th.

DESIGNS FOR ARTICLES OF UTILITY.

Provisionally Registered from 18th to 23d October, 1852.

Oct. 18th,	475	Charles F. Nicoll, Threadneedle-st.,—"Vest collar and fastening."
23d,	476	Thomas Allan, Adelphi-terrace,—"Battery plate-frame."

DESIGNS FOR ARTICLES OF UTILITY

Registered from 30th October, to 16th November, 1852.

Oct. 30th,	3380	W. Caldwell, Glasgow,—"Berth settee."
Nov. 2d,	3381	G. Duncan, A. Hutton, and C. Thomas, Chelsea,—"Spring-holder strap."
—	3382	Clark and Timmins, Bloomsbury-street,—"Table fasteners."
6th,	3383	J. D. Everett, Totteridge,—"Protean puzzle."
9th,	3384	Robert Lambert, Goree Piazza, Liverpool, Thomas Danby, Toxteth-park, Liverpool, —"Gold-sifter."
10th,	3385	William Taylor, Birmingham,—"Inside shutter-bar."
11th,	3386	Dobson & Barlow, Bolton-le-Moors,—"Upper part of a weight hook for lapping machines."
12th,	3387	George Hyde, Fleet-street,—"Portable writing-case."
16th,	3388	D. & E. Bailey, High Holborn,—"Smoke guard."
—	3389	B. Cogswell, Strand,—"Six-shot rifle pistol."

TO READERS AND CORRESPONDENTS.

G., Glasgow.—He gives us three practical queries which are answerable only by reference to actual works. Nothing can prevent immoderate condensation but a good system of clothing. What the loss would be at fifty fathoms, it is really impossible to say. We should certainly not put in pipes any larger than if the boiler were on the same level. Perhaps some of our readers will inform him as to "the names of some collieries where steam is led down the pit to an engine."

Wire Type.—It is true that a movement has been made for the establishment of a company for the production of types by pressure; but nothing has been heard of it lately. The machine which carried off an Exhibition prize, uses wire as its raw material. This is supplied in a regular stream, and a hardened steel die strikes the presented end, impressing the intended letter upon it. The type is then severed from its length of wire, and the letter is complete. The process is somewhat like nail-making. A hundred per minute is said to be the produce, and the letters are sharp and well-defined.—See page 166, Vol. II., *P. M. Journal*, on this subject.

Mechanic, Leeds.—Mr. Crabtree of Godley, near Halifax, had a beautiful card-making machine at the Exhibition. The cloth or web on which the card-wires are to be fastened, is led gradually, end-wise, through the machine, and, as it proceeds, is regularly punctured with a pair of holes, one after the other, to receive the wires. There is a coil of fine wire mounted on a reel, and this is gradually drawn into the machine, and a certain length, rather less than an inch, is cut off, and bent into the shape of the letter U; it then receives a second bend, at right angles to the first, and is finally inserted into the two small holes previously made in the cloth. By the peculiar and beautiful arrangements of the machine, the two next holes are punctured in the cloth by the sides of the previous, and another U-shaped wire is cut, bent and inserted; and this operation is repeated until the whole breadth of the cloth has been filled, when the material is moved endwise, sufficiently to allow another row to commence, and this time the cloth is moved sideways, in the opposite direction to that in which it was moved last, and *vice versa*, each forward row of wires until the whole length of the cloth is complete.

One interested in Steam Navigation.—We have seen the paragraph, and although the inventor of the plan has applied for a patent for it, that proceeding does not shake our opinion of the absurdity of the idea.

A. R. W.—Our last note is a reply to a similar inquiry.

A Reader.—The engine has been often described. Its success was too equivocal to call for its revival here. Indeed, we are by no means sanguine of the success of the "four 168 inch cylinders." We shall see.

Received.—"Morse's Patent." By the Hon. Amos Kendall.—"The Mechanic,"(N.Y.) Parts I. to XI., but with Part IV. wanting.—"The Canadian Journal," for August and September.

Apalachicola.—Gold dollar received. We intended no slight in our remark, and we regret that our correspondent has thought otherwise. We are constantly charged heavily for useless communications.

Enquirer.—Quite true. Mr. Potter says—"The most successful and curious pattern (within my recollection), to be classed under this head, was the diorama pattern, produced by Messrs. Simpson & Co., of Foxhill Bank, about twenty-five years ago. I should hardly like to trust myself with naming the quantity printed from this one pattern which for a time was the novelty of the day, and had for a short period a sale unequalled, I believe, by any pattern ever printed. I may fairly estimate the quantity produced by the original printers, and by others who copied and made variations from it, as being not far short of 300,000 or 400,000 pieces. Like all extreme novelties it had its day, and I do not think that any printer could now, by reproducing the pattern, or any near variation from it, tempt a demand in the whole world's market, that would pay the cost of production. *So utterly distasteful, and so instantly recognised, are all reproductions of this class.* 'Lane's net' is the original of a style with which the world was supplied, and, I might say, literally clothed for a short time. It was produced in the London market upwards of forty years ago. A third, though not so extensive perhaps in its range of consumption, and still more simple in its novelty, was an accidental selection of one out of perhaps hundreds or thousands of the class, and if there be any credit in the matter, I might own myself its original designer. It is a small broom, or brush pattern, produced upwards of twenty years ago, and, for a pattern of its style, had a very remarkable sale—certainly, within my own knowledge, to the extent of a quarter of a million of dresses. I can hardly attempt to give a rule for the success of these patterns. They are simply curious instances of the fitful nature of demand. Lane's net does possess clearness, neatness, and novelty. The diorama was, strictly speaking, odd, capable of great variety in colouring. The broom had character distinct in its size; had it been half the size, it would have been ineffective; if larger, absurd, and consequently unsaleable."

THE LAST EXPERIMENTAL SCREW SQUADRON OF THE NAVY.

Ship's Name, and Designers.	Tonnage, O M.	Length between Perpendiculars.	Breadth, Extreme.	Mean Draft Designed.	Area Midship Section Designed	Displacement Designed	Guns.	Cylinders: No.	Cylinders: Diameter.	Cylinders: Stroke.	Revol. Designed	Multiple of Gearing.	Screw: Diameter.	Screw: Pitch.	Lbs. on Valve.
		ft. in.	ft in	ft. in.	ft.				in.	ft in			ft in	ft in	
Arrogant .... Fincham. Engines, Penn. (Trunk.)	1861	200 0	45 4	20 0	623	2690	47	2	=55	3 0	60	None	15 6	15 0	$4\frac{3}{4}$
Dauntless.............. Fincham. Engines, R. Napier.	1569	218 1	39 9	17 0	549	2420	33	2	84	4 0	30	2·2758	14 8	17 9	10
Highflyer.............. Somerset House. Engines, Maudslay.	1153	192 0	36 4	15 9	465	1737	21	2	$55\frac{3}{16}$	2 6	55	2·0	12 0	10 0	14
Encounter.............. Fincham. Engines, Penn. (Trunk.)	953	190 0	33 2	13 11	386	1482	14	2	=55	2 8	80	None	12 0	16 0	6

These four ships have lately returned from a trial cruise of a couple of months, during which they have been tested against each other on various points of sailing and steaming. There has not, however, been any bad weather of sufficient duration to allow of the formation of any very positive conclusions as to their relative merits under such circumstances. In other respects the trials have been of average value. The ships all started full of coal and other stores, and all, except the *Dauntless*, had very recently been in dock, which, as will be seen, gave them considerable advantage, their bottoms being clean.

For the information of most landsmen readers, it will be useful to explain that, in trials at sea—there being no buoys or fixed marks, such as are used at regattas—the distances of the ships from each other are ascertained by a trigonometrical process, the elements of which are—the height of each ship's mast from the hammock-netting, previously ascertained, and the angle subtended by the mast as a tangent, which is measured with the sextant at the beginning of each trial, and at other periods up to the finish, as directed by signals from the commander-in-chief. In trials "on a wind"—that is, beating to windward, or towards an imaginary point in the direction of the wind—the distances gained or lost are estimated in that direction, and are irrespective of the distance traversed by the ship in endeavouring to reach the imaginary point, each ship sailing as close to the wind as she can, without regulating her course by the compass. But when a trial is made under any other direction of the wind, so that a course by compass may be pointed out, and adhered to with equal facility by every ship, the gain or loss of each is reckoned by the straight distance passed over, and is generally termed "gain" of one ship over another; whereas, when beating to windward, the successful ship is said to have "weathered" upon the others. The distances are reckoned in fathoms; but, as affording a more intelligible idea of the performances of the ships, the fathoms gained during the trial are here reduced into nautical miles per hour. These matters being premised, we proceed to the account of the trials.

The squadron left Spithead on 21st June, and next day there was a trial on a wind. Force of wind, 3 to 5 of Beaufort's scale, steady, but increasing. The increase in the strength of the wind appeared to give the *Dauntless* and *Highflyer* an advantage. Smooth water; 6 hours' trial:—

Arrogant weathered on......	*Dauntless.*	*Highflyer.*	*Encounter.*
Knots per hour,........	0·158 ...	0·178 ...	0·306
		0·0213 ...	0·150
			·0427

June 25.—Trial off the wind; force, 5 to 7, with some sea. This trial only lasted $1\frac{3}{4}$ hour, a thick squall of wind and rain having come on. The wind shifted, and came ahead, after $1\frac{1}{2}$ hour's sailing, which virtually made a new trial. The final result showed in favour of the *Arrogant* and *Highflyer*, but it is stated that the *Dauntless* was rapidly going to the front before the shift of wind, which took her aback, and at which period—

Dauntless had gained on	*Arrogant.*	*Highflyer.*
Knots per hour, ...	0·541 ...	0·492

The final result was—

Arrogant gained on	*Highflyer.*	*Dauntless.*
Knots per hour,........................	0·150 ...	0·445
		0·410

The *Encounter* left several miles astern. Both *Encounter* and *Highflyer* pitched very much.

June 28.—On a wind. Force, 4 to 5. 5 hours 45 minutes:—

Arrogant weathered on	*Highflyer.*	*Dauntless.*	*Encounter.*
Knots per hour,..........	0·0231 ...	0·0411 ...	0·965
		0·0171 ...	0·941
			0·921

June 30.—Steam and sail off the wind, but the wind was barely sufficient to make the sails useful. A long heavy swell, with a smooth surface. 6 hours:—

Encounter gained on..........	*Highflyer.*	*Dauntless.*	*Arrogant.*
Knots per hour,..........	0·137 ...	0·29 ...	0·753
		0·129 ...	0·617
			0·488

July 1.—Before the wind. Force, 5 to 6. A long swell, and the ships rolling much at times. In $7\frac{1}{2}$ hours, 56 miles were run by Massey's log:—

Arrogant gained on...	*Highflyer.*	*Encounter.*	*Dauntless.*
Knots per hour,.........	0·146 ...	0·164 ...	0·445
		0·0138 ...	0·264
			0·270

July 3.—Steam and sail on a wind. Force, 3 to 4. After two hours' trial, the *Highflyer* broke the link of the link-motion of one engine (with which all are fitted, except the *Dauntless*), which is made of cast-iron. This placed her at an undue disadvantage at the end of the trial, which lasted $3\frac{1}{2}$ hours. The *Encounter* kept closer to the wind than the other ships, so that her sails were "lifting" during the greater part of the trial, which, as the wind was light, gave her an advantage in the apparent result, that could scarcely be said to be fairly obtained:—

Encounter weathered on......	*Dauntless.*	*Highflyer.*	*Arrogant.*
Knots per hour,..........	0·119 ...	0·551 ...	1·34
		0·433 ...	1·22
			0·788

On the next evening, steam was got up, and the squadron proceeded at an easy pace towards Lisbon, where they arrived on the 5th, and remained until 12th July, the *Highflyer* working with one engine. During this period, the *Encounter* secured her bowsprit, which was found to be sprung; the *Highflyer's* link was completed; and the *Dauntless's* bottom, which was very foul, partially cleaned by "hogging."

In going out of the Tagus, on the morning of the 12th, the *Arrogant* unfortunately struck on a rock near the fort St. Julian, by which, as afterwards appeared, she lost a quantity of false keel, and one piece was twisted out of its place without being torn off, forming a complete drag, and interfering much with her steering. The effect of this accident was manifested in the afternoon's trial under steam and sail off the wind. Force of wind, 4. 4 hours' trial. 36 miles run:—

Dauntless gained on........................	*Encounter.*	*Arrogant.*
Knots per hour,........................	0·0615 ...	1·1

July 13.—Before the wind. Force, 5. 4 hours. After $1^{h.}\ 50^{m.}$, *Arrogant* being unable to keep up, lowered the propeller, and called steam to her aid. 25 miles were run by Massey's log, at the end of which—

Highflyer and *Encounter* had beaten *Dauntless* at the rate of 0·0615 knots.

On the evening of July 14, the squadron steamed slowly through the Gut of Gibraltar. The *Encounter* was sent in, and the *Highflyer* ahead, where Admiral Dundas was expected to be with his fleet, which the screw squadron was to join. In the meantime, the *Arrogant* having stopped in the Gut for a while, the *Dauntless* tried the experiment of turning round in a circle, with the helm hard over, and at about half speed. The speed was 5 to 6 knots, and the circle described was estimated at 400 yards diameter. On the next day the Admiral was fallen in with, with a fleet consisting of the *Britannia*, 120 guns; *Trafalgar*, 120; *Albion*, 90 (of rolling notoriety); *Vengeance*, 84; *Bellerophon*, 78; *Phaeton* and *Indefatigable*, 50 gun frigates; and *Fury*, paddle-wheel steamer of 515 H.P. In the course of the day, the *Terrible*, 800 H.P., but only half her boilers in, reducing her for the present to 400 H.P., and *Firebrand*, 400 H.P., both paddle-wheels, arrived from Gibraltar. The screw squadron was absorbed into the fleet, the *Dauntless* being placed in the lee line, and the other three in the weather line.

There was a trial of sailing on the 17th, when it blew pretty fresh, and the *Trafalgar* ran down to leeward about 5 miles, and hove to. The others then made sail, and ran down to her; but the distance was so short, and the start made so hurriedly, that those who happened to be first in making sail got down to the ship first. But when the trial of returning against the wind to the flag-ship came on, it was fairer. No distances were measured; but the *Phaeton* was first, as usual, *Highflyer*

second. The *Dauntless* missed stays, before which she was gaining on the *Highflyer*. This mishap was nearly being visited on her by a collision with the *Albion*, which was happily just avoided.

July 30.—All the steam-ships got up steam, and tried the experiment of going to windward, either by beating with the help of sails, or by putting their heads to it, as each deemed best. The latter plan was adopted by the paddle-wheels and by the *Dauntless*. The *Encounter* set fore and aft sails, but afterwards took them in, and went head to wind. The *Highflyer* set all sail, and tacked. The trial lasted two hours, and the ships came in in the following order, and very close together:—*Fury*, *Terrible*, *Encounter*, *Dauntless*, *Highflyer*, *Arrogant*. The *Terrible* sent down all her yards. Force of wind, 4 to 5.

August 4.—In the afternoon, the *Highflyer* and *Encounter* chased the *Phaeton* to windward. The *Encounter* was first.

August 5.—The screw squadron took leave of the Admiral, and proceeded to Gibraltar, under steam, head to wind. Force of wind, 5, with a little sea. The topgallant-masts and yards were sent down. Gibraltar was reached by the *Dauntless*, going 8 knots, in four hours, and by the *Highflyer* and *Encounter* a few minutes afterwards. The *Arrogant* did not arrive for two hours more. According to previous experience, the *Encounter* should have been first, but her inferiority on this occasion was attributed to bad coal and foul tubes, having been under steam the night and day before.

The vessels coaled at Gibraltar, with the exception of the *Highflyer*, and excellent coal it was. The *Dauntless* had her bottom again partially cleaned by hogging, and the *Arrogant* contrived to pull off the broken piece of false keel that had hitherto impeded her so much. The keel, however, was, of course, still in a very rough state.

After leaving Gibraltar for England, the first trial of interest was on the 13th August, when the *Dauntless* tried her rate with the *Highflyer*, the latter having her screw down, and connected so that it could not turn round. Wind on the quarter. In 1½ hour, the *Dauntless* gained at the rate of 0·66 knot per hour. The *Highflyer* then raised her screw, the *Dauntless* lowering hers. This trial continued two hours, and the *Highflyer* gained exactly at the same rate, viz., 0·66 knot. The *Dauntless* then raised her screw, and again gained at the rate of 0·117 knot.

August 14.—The same ships were ordered to chase the *Arrogant* off the wind. Force, 4. $2^{h.}$ $10^{m.}$ The *Encounter* left far astern.

The *Dauntless* gained on	*Arrogant.*	*Highflyer.*
	1·705 ...	·3

August 16.—Steam. The *Arrogant* was towed by each of the others in succession for two hours. The result by Massey's log from the *Arrogant* was as follows:—

Highflyer towing, 5·55 knots; *Encounter*, 6·1; *Dauntless*, 6·85.

Upon getting the screws up again after the trial was over, the *Dauntless* signalled that, from an accident to the lifting gear, her screw could not be got up, and she accordingly sailed with it down for two days. This ship is fitted with two long vertical screws, connected by beveled gear, and worked by crank-handles, for lifting the propeller. It may here be remarked that this system, though much adopted, has been found in most instances to give a great deal of trouble, besides imposing great weight on the stern of the ship; and the prevailing opinion is in favour of a simple arrangement of chains and tackles, which can either be "walked up" at once, with ease, by the large crew of a man-of-war, or brought to the capstan, in either case affording a powerful purchase, and admitting of the screw being lowered by a couple of hands, with as much ease as a quarter boat; whereas the screw-elevating apparatus requires nearly as many hands to lower as to raise the propeller.

August 20.—Steam. The *Arrogant* and *Highflyer* successively towed the *Dauntless* for two hours each. Result by Massey's log from the *Dauntless*:—

Arrogant towing, 5·15 knots. *Highflyer*, 6·2.

August 24.—Trial before the wind. Force, 3 to 4. Duration, four hours:—

The *Highflyer* gained on....................	*Encounter.*	*Dauntless.*
Knots per hour,..............................	0·0027 ...	0·0301
		0·0283

August 26.—Trial of time taken in tacking. Wind, 3 to 4. A long swell:—

		Min.	Sec.	
Mean of 6 tacks	.................*Arrogant*,	4	5	From putting
" 5 "	.................*Highflyer*,	4	30	the helm down
" 6 "	.................*Encounter*,	5	0	to hauling the
" 6 "	.................*Dauntless*,	5	46	headyards.

August 27.—Steam. Light winds and calms, a high swell on the beam; rolling 8 to 10 degrees each way. Duration, 5¾ hours. 56·4 miles run:—

The *Dauntless* gained on	*Encounter.*	*Highflyer.*	*Arrogant.*
Knots,..........................	0·154 ...	0·36 ...	1·22
		0·285 ...	1·139
			0·853

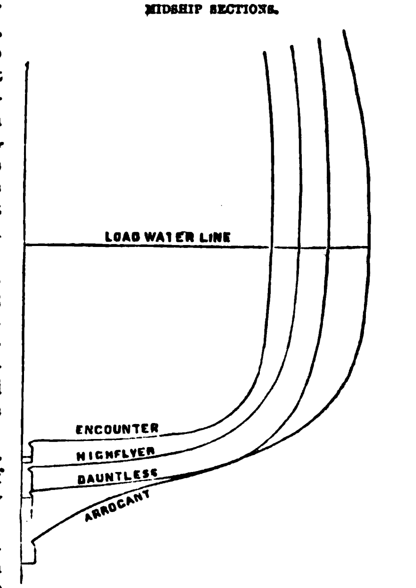
During the first two hours, the *Highflyer* held her own, and the *Encounter* slightly gained on the *Dauntless*.

August 30.—After a failure in an attempt at a trial, from the variableness of the wind, the *Highflyer* and *Dauntless* began again, the trial lasting $4^{h.}$ $10^{m.}$:—The *Dauntless* weathered on the *Highflyer* at the rate of 0·051 knot. This was the last trial, and on 1st September the ships anchored at Spithead.

Before proceeding to the deduction of any practical conclusions from these trials, it will be necessary to enter into the individual peculiarities of each ship, as far as can be done with certainty. And, first, let us compare their relative forms. The annexed midship sections are correct for the *Arrogant*, *Dauntless*, and *Encounter*. That of the *Highflyer* is an approximation, but cannot be far out, being made principally from actual measurement, and checked by the known area. The *Arrogant's* bow is rather sharp, particularly below, and is altogether very beautiful, the form of midship section giving great facilities, as every shipbuilder knows, for easy and fair lines. The section is also very well proportioned for the combination of carrying powers, with stability and easiness of motion in a seaway. Her run is moderately fine, but she has the square tuck—that is, the after water-lines, instead of terminating at the fore sternpost, are carried to the after one, so that the foreside of the screw aperture presents a flat surface, as if the ship had not been built for the screw, but had an aperture afterwards cut for it. The edges of the square tuck are, however, rounded off as much as possible, and there is none below the shaft. The *Arrogant* is the only ship that has done well as to speed under steam with the tuck, and it is probable she would do better without it. The speed of the *Dauntless* was increased by the alteration from the *square tuck* to *no tuck*, from 7·3 to 10·26 knots, a great difference indeed. As the *Arrogant's* screw is considerably less in diameter than the draft of water, and is kept as low as possible, it does not come in the way of the square tuck so much as if it were of a larger diameter.

The section of the *Dauntless* is very different from that of the *Arrogant*, the ship having been intended, as the builder himself informed us, for a steamer, and to be able to go into shallow water. It is disadvantageous for sailing, as being wanting in stability, and not so favourable to fine lines as if there were a rise of floor. The bow is short, and does not "flare out" much, and there are no hollow lines. The run is long and fine, and flat under the counter; and is unnecessarily fine as compared with the entrance, whilst the counter is very heavy, and drags considerably in the water.

MIDSHIP SECTIONS.



Although designed by a different hand, the form of the *Highflyer* is surprisingly like that of the *Dauntless*. The foregoing description will exactly suit her, with the exception that the counter is light and high. In fact, the forms of these ships are practically identical, although the *Highflyer* is certainly longer. This similarity of form will be found useful in comparing their performances. The *Highflyer* carries all her guns on the upper deck, and they are some three feet higher than those of the *Dauntless*, so that, though she is equally crank, the lee guns are not so soon rendered useless.

The *Encounter*, by the same builder, is very like the *Dauntless*, but is a little sharper and longer, and has a hollow line at the lower part of the bow. The sections are practically identical in form.

Next, as to rig and canvas. All the vessels are full ship-rigged, the *Arrogant* like a first-class 50-gun frigate, with the exception that, above the lower masts, the main and fore are alike. The advantage of this is, that a smaller number of spare sails, topmasts, and yards will suffice, as they fit indifferently to either mast. The *Dauntless* and *Encounter* are also

rigged on this system. The rig of the latter ship is very light, and her canvas low and small. The sails on the mizzen-mast are mostly kept furled, as causing her to carry too much helm. All the ships have large gaff-sails on every mast. Their general appearance is not by any means that of the traditional man-of-war; even the *Arrogant* often seems a river East Indiaman, and the *Highflyer* is a perfect Aberdeen clipper. The boilers of all the ships are short of steam, the *Arrogant's* being the least so, and the *Dauntless's* the most.

It is to be regretted that the value of the trials between the *Arrogant* and *Dauntless* is much impaired by the bottom of the latter being so foul at the beginning of the cruise, and by the *Arrogant's* losing her keel at the latter part of it.

One object mentioned in the newspapers, as sought to be obtained by the cruise of this squadron, was the determination of the value of different proportions of power to sizes; and here the *Highflyer* and *Dauntless* afford data for useful comparison, their forms being, as before observed, almost identical, but the horse power of the *Dauntless* being much greater than that of the *Highflyer*. In the first place, it must be observed that the machinery of the *Dauntless*, having been made in the earlier times of screw propelling, are enormously heavy, and do not by any means treat the new propeller fairly, since they have imposed upon the ship the weights which she would have been obliged to carry with the paddle-wheel. As an illustration, the heaviest paddle-engine is, of course, the beam, even with malleable-iron framing; yet those of this description in the late ill-fated *Birkenhead* weighed—total, 452 tons for 556 H.P.; while the machinery of the *Dauntless*, for 580 H.P., weigh no less than 426 tons. The weight of the *Highflyer's* machinery is certainly small—it is not known to us, but is probably near 190 tons for 250 H.P. It is not intended to argue from this, that the *Highflyer* has an advantage in the results to be expected from her power, as regards speed, &c.; but it is clear that, in deciding upon the proportion of power for a ship, regard must be had to the displacement it will require to carry it. In the *Dauntless*, for instance, if the 426 tons of displacement had represented say 680 H.P. instead of 580, it would have had a marked influence on her performances.

The trial of 27th August, full speed, under steam, gives the following elements of comparison between the *Highflyer* and *Dauntless*, as far as they could be procured from each ship:—

	Dauntless.		*Highflyer.*
Speed, ...knots,	9·8	......	9·44
Slip, per cent., ...	16·2	......	...
Ratio of midship section to area of screw's disc, ...	3·09	......	4·11
H. P. indicated, ...	1175	......	720
H. P. per foot of midship section, ...	2·14	......	1·54

The principal thing to be learned from this trial appears to be, the superior proportions of the *Highflyer's* screw. Its slip at the measured mile was 11·14 per cent., and there is no reason to suppose it was greater on this occasion. If the *Dauntless's* screw had been similarly proportioned—supposing it to have had an adequate diameter—her speed would have been raised from 9·8 to 10·29; and supposing the boilers to have been able to steam to it, there would have been a further slight increase, due to the greater number of revolutions, and consequent higher power exerted by the engine, when applied to a screw of finer pitch and less length. However, the ratio of horse power to midship section shows a higher performance for the *Highflyer* than can be accounted for by the lesser slip alone; and accordingly we find that she is, though of similar form, of greater length than her competitor, as 0·413 to 0·398, these numbers being obtained by dividing the length—not, as usual, by the breadth—but, more accurately, by the area of midship section.

In the published Admiralty record of experiments, there is a column, among other analogous ones, of relative numbers expressing the value of the performances, calculated by the formula, $\frac{\text{speed}^3 \times \text{mid. sect.}}{\text{indicated H. P.}} = x.$ This gives a very useful approximate result, and it will be applied in further consideration of the experiments under present notice. Thus, in the case of 27th August, the value of x is, for the *Dauntless*, 431; the *Highflyer*, 543. These remarks will explain, at least in some degree, the difference shown in favour of the *Highflyer*.

On the 16th August, the *Arrogant* was towed successively by each of the other ships:—

	Dauntless.		*Encounter.*		*Highflyer.*
Indicated H. P., ...	1160	...	560	...	500
Combined mid. sec. of the two ships,	1172 ft.	...	1009 ft.	...	1088 ft.
Do. per H. P., ...	1·01	...	1·80	...	2·17
Speed obtained, ...knots,	6·85	...	6·10	...	5·55
$\frac{\text{Speed}^3 \times \text{mid. sec.}}{\text{H. P.}}$ = ...	324·3	...	409	...	372

In order to compare the useful effect of power as expended on two ships in towing, with that by a single ship from her own engines, the coefficients have been taken from the Admiralty tables of ships having as nearly as possible the same proportion of horse power to midship section, that the horse power of the *Dauntless* bears to the combined sections in the present trial. The mean of these coefficients is 507, the slip being deducted in per centage from the power. No comparison could be similarly made for the *Encounter* and *Highflyer*, the power being so small that no similar proportion could be met with in the tables. We may thus gather that a great deal of power is wasted in slip in towing, as appears by deducting the actual slip of the *Dauntless* on this occasion, from the power in the formula—39 per cent.—by which the coefficient becomes 510, practically that due to the power employed.

The *Encounter's* coefficient is higher than any of the others, which may be due to her form, as she has a little hollow in the lower part of her bow, and her length is also greater than any of the others, being 0·489.

The *Highflyer's* coefficient is larger than that of the *Dauntless*. This may be attributed to her greater length, to better proportions in the propeller, and to the much greater area of disc of screw in proportion to the horse power, though it is less in comparison with the combined midship section.

A calculation has been made from this experiment, which shows that in towing, as in running singly, the speed obtained is exactly what is due to the power effectively employed—that is, after deducting slip. This, the reader may say, is obvious enough on the face of it. Still, an illustration of the action even of known laws may not be without its use. To proceed then: The *Arrogant* may be safely stated to be equal to a speed of 8·3, with 700 indicated H. P. As there is 8 per cent. slip, the effective H. P. is 644. The speed, power, and slip of the *Dauntless* are, similarly, 9·8, 1175, and 16. Now, the *Dauntless* towed the *Arrogant* 6·85 knots, with 1160 H. P., and 39 per cent. slip, which makes the effective H. P. 698. Now, in calculating what power is necessary to drive the *Arrogant* at 6·85 knots, by the "rule of the cubes" (H. P. $\sqrt[3]{}$) we get 362 H. P. The same process applied to the *Dauntless* gives 336 H. P., and 362 + 336 = 698, exactly agreeing with the experiment. Of course, the *exact* coincidence here is not a thing to be expected, from the errors which will more or less affect the most carefully-conducted experiments. In this case, it is, no doubt, the result of a balance of errors, though there is no reason to suspect the presence of any material mistakes.

The Highflyer towing Dauntless, compared with Dauntless towing Arrogant.—These experiments furnish the following data:—

	H. towing *D.*		*D.* towing *A.*
Speed, ... knots,	6·2	......	6·85
Slip, per cent., ...	35·9	......	38·8
Combined midship section, ...	1004	......	1172
Indicated H. P., ...	595	......	1160
Feet, midship section, per H. P., ...	1·7	......	1·01
Combined midship section to screw's disc, ...	8·88	......	6·89
$\frac{\text{Speed}^3 \times \text{mid. sect.}}{\text{H. P.}}$ = ...	401·5	......	324·3
Total displacement, ...tons,	4157	......	5070
Equal to	0·82	......	1·0
Combined midship sections, ...	0·87	......	1·0

The last two items show that the displacements of the two pairs of ships are so nearly in the direct ratio of the midship sections, that the element of displacement may be safely left out of the question, in seeking the reason of the *Highflyer's* coefficient (calculated from the midship section simply) being so much above that of the *Dauntless*. It will be observed that the slip is very nearly the same in each case. It appears that the difference is mainly due to the form of the *Highflyer* being better for dividing the water than that of the *Arrogant*. The *Dauntless* is *common*, as Euclid would say, to both cases, and therefore her form does not affect the comparison. Now, as to the others: the *Highflyer* is longer than the *Arrogant*, as 0·413 to 0·321, which is a great difference, and much more than enough to compensate for a rather less favourable form of midship section. It must be borne in mind, that the speed here spoken of is that producible either by sail or steam, with the vessel upright, and therefore independently of the question of stability; so that the higher result of the smaller midship section is not to be used in defence of the narrow, flat, and crank *form* of section of the *Highflyer*, which is deemed indispensable by many builders when a long ship is to carry weight. Without going to the extreme—into which Sir W. Symonds fell—of making the immersed part of the midship section a mere triangle, it may safely be laid down, that, to get a given displacement, with a given speed, length, and area of midship section, it is not necessary to make the ship narrow, as, by raising the floor to a moderate angle, still keeping the turn of the bilge

under water, the area of midship section may be kept smaller, and the speed secured, so far as it depends on that. At the same time, the important advantage of stability is also obtained without any sacrifice of easiness of motion, as the volumes of emersion and immersion may still be equalized to any extent desired.

To return to our comparison. It has been remarked already, that the slip is nearly the same in each case, the slip of the *Dauntless* only exceeding that of the *Highflyer* by 1 per cent. It might have been expected that the *Dauntless* would have had more comparative slip than this, as greater power is expended on the resistance. Her larger area of screw's disc, however, enables the power to be used as effectively as the smaller proportion of the *Highflyer*,—not that the screw of the *Dauntless* might not be larger still with advantage in towing, as there is no doubt it might under other ordinary resistances, for we have seen that the *Highflyer* had less slip from the fineness of the pitch.

The revolutions of the engines were reduced by the extra resistance in towing—in the *Highflyer*, 4 per cent.; in the *Dauntless*, 6·3 per cent. The engines were thus enabled to exert all but their full power, the most so in the case of the fine pitch; from which we may infer, that the screw is much better adapted for steam-tugs than the paddle, which, in towing, reduces the power of the engine by a very large per centage, whilst the slip is as great as that of the screw in these experiments.

Our consideration of these towing trials has been thus far extended, because the screw has as yet been but little used for towing, though, as it has been attempted to show, it is well fitted for profitable use in that description of service. With paddle-wheels, in order to avoid the loss consequent on carrying engines of extra power to compensate for the reduction in the number of revolutions when towing, some of the Government tugs have been fitted with spur gear, exactly resembling the back speed of a lathe, having a multiple of two or three to one, to enable the engines to reach their proper speed. It is scarcely necessary to compare this cumbrous contrivance, requiring wheels of extra size, to say nothing of the ordinary extras, under the head of weight and top-hamper, in the shape of wheels and boxes, with the neatness and simplicity of a pair of small direct connection-engines driving a large fine-pitched screw. In the latter plan, a high speed of piston is made consistent with smooth action by a moderately long stroke, which enables all the moving parts to be light, and by employing the simplest possible arrangement, say that of the locomotive with guides, the oscillating, or the trunk. The innovation of using the screw for towing, specially, will be tried some time or other, and with undoubted success, if the results of the above experiments are to be trusted.

Speed from the Screw with High Power.—There is a very generally received opinion, that the screw is not adapted to the high speeds now demanded and obtained in passenger vessels from the paddle, and the speed of the Government full-powered vessels is unfortunately so low as to corroborate that idea. For instance, in the trials recorded in this paper, we have the *Encounter* and the *Dauntless*, both large vessels, of tolerable length, and with sufficient nominal horse power, yet, in a trial of nearly six hours, they averaged but 9·8 and 9·64 knots, speeds falling short by two knots of what is fairly to be expected from vessels of such dimensions. The reason of this we take to be, chiefly the deficient steaming powers of the boilers, and, not least, the form of the ships. Whether we adhere to Scott Russell's wave-line or not, it is established by all experience—from the *Eclipse* of David Napier, and the old Woolwich packets of the younger Lang (his *Ruby*, built in 1836, is still equal to many vessels one-third her age), down to the *Great Britain*, the *Banshee*, and the *America* yacht—it is absolutely necessary to have hollow water-lines in the bow to obtain that speed. The performance of many vessels built on this principle, in crossing the channels in all sorts of weather, proves also that speed with a hollow bow can be combined with seaworthy qualities. If, however, the form, proved to be that best suited to develop the power of the paddle-wheel, be denied to the screw, and the old "bruisewater" form be imposed upon it, it is manifest that the result cannot be high speed. The late performances of the *Cleopatra*, Australian packet by Denny, which, with the same dimensions as the *Dauntless*, but with only 300 H. P., has reached an equal or greater speed. The *Great Britain*, on her late voyage to New York, the *City of Glasgow*, and one or two others, although, for want of power, they do not come up to the 12-knot standard, are satisfactory evidence that high speed—the very highest—are attainable on the ocean with the screw. Indeed, how can we conceive that a propeller, having *less slip* than the paddle-wheel, should not be capable of developing high speeds as well as low, if only the proper proportions are observed?

As so much has been said in favour of hollow lines, it may be asked why the *Niger*, *Sharpshooter*, and *Rifleman*, all of the Royal Navy, do not go better; for their forms, particularly the *Niger's*, are, to a lover of hollow lines, very beautiful indeed? To this we can only reply, that, as far as our information goes, the fault with the *Niger* is the old complaint of the boilers. The screw is also of coarse pitch, 17 ft. to 12 ft. 6 in. diameter, and the slip is rather more than some others. Her highest coefficient is 483 in the tables, the mean indicated pressure being 15·63 lbs., and the revolutions barely reaching the intended number. As to the *Rifleman* and *Sharpshooter*, their slip is so great, that it seems that their screws must have been too small. The first does not double her nominal horse power, and the other only barely does so. It is hoped these facts will suffice to exculpate the hollow bow from suspicion in these cases, which are but isolated exceptions.

The trials of the relative advantages of steaming head to wind, and beating to windward under sail and steam, have not been carried to an extent sufficient to enable us to judge which is the best system. But, as far as opinion may be of value, it seems to be that of the witnesses to the trial of 30th July, that, in moderate weather at least, considerable economy may be effected by the use of sails, without any loss of time. This is a point upon which the commanders of the mercantile screws could give useful information, and we hope that some of them will do so. Our pages shall always be open for practical information of this nature. We have understood that their practice is to steam against light winds, but always to beat when it blows fresh. As all these vessels have small power, this seems the most natural course to pursue.

Tacking.—This is a point which, though obviously of great importance, yet depends so much upon skilful handling, that it is better to forbear many remarks on the trial of 26th August. Still we may observe, that the *Arrogant* took the shortest time in stays; she is also the shortest ship for her size. The *Dauntless* took the longest time; she is absolutely the longest, though not for her size. The *Encounter* comes next in length of period; she is the longest of all for her size, and has the least canvas. Without particularly alluding to any of the tactics pursued on this occasion, it should be pointed out that the ancient practice, with anciently short ships, of turning them round as quickly as possible, even though they should get sternway in stays, is most objectionable when applied to ships of modern length. They should be allowed to sail round as gently as possible, making a long sweep, and keeping headway until the sails are again full.

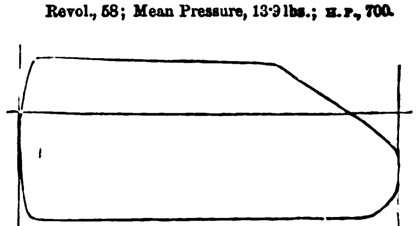
General Sailing Qualities.—The *Arrogant* and *Dauntless* appear to have about equal speed through the water; perhaps the *Dauntless* has slightly the advantage. The latter, however, is so crank, that, whilst the former is standing up as "stiff as a church," she heels over, until it is necessary to close the lee ports, and give up the use of the lee broadside. The *Dauntless* is the more weatherly of the two, probably from the great distance between the masts enabling the yards to brace up sharper.

The *Highflyer* is not equal to either of the last, though not much behind them. It is said that her captain has applied to the Admiralty for more canvas, trusting apparently to the great height his guns—all on the upper deck—are above water, so that she may heel over the more without rendering them useless. She is about equally crank with the *Dauntless*, as might be expected from the general similarity of their forms, particularly as to midship and other sections.

The *Encounter* runs very well before the wind in fine weather, but when it blows hard, she is left behind by the rest. This is most likely owing to her smaller size and light rig, which may not enable her to set an adequate amount of canvas at such times. On a wind, she is leewardly, compared with the others; here her light draft of water is much against her. With the sail she has, she is not inconveniently crank. Neither the *Highflyer* nor *Encounter* are so easy as the other two; they pitch heavily.

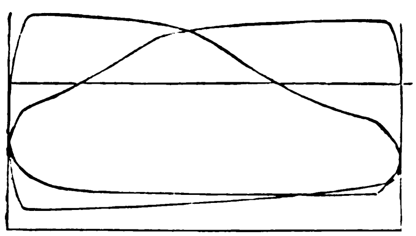
There have been some trials of slow steaming expansively, but the only point that has been determined by them is, that to reduce the initial pressure by throttling, when working expansively, is exceedingly wasteful, and requires all the benefit of the subsequent expansion to make up for the great loss by condensation in the cylinders. It is necessary to explain here, that the reason why so wasteful a system is pursued, or at least was during this cruise, is not that the engineers in charge do not know the evil of it, but it results from the necessity of the ships keeping in line, and at

ARROGANT.
Revol., 58; Mean Pressure, 13·9 lbs.; H.P., 700.

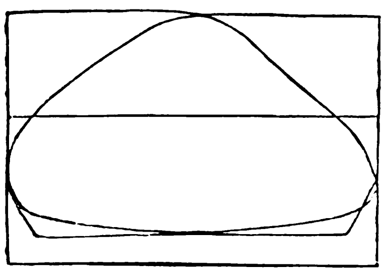


proper distance, when not trying speed. The *Arrogant* being the senior officer's ship, and therefore the leader, and also being the slowest steaming ship, could work with the throttle-valve open, on the highest grade of expansion, and therefore the expansive working of her engines would be fairly tested. But the other ships being of greater speed, they would be, and were, obliged to throttle the engines more or less, in order to keep in station. Thus the loss above described takes place from radiation and condensation in the boilers and steam-pipe, the temperature being necessarily higher there than in the cylinders, and the motion of the steam so slow, that time is afforded for the escape of heat. The principal loss, however, takes place in the cylinders by condensation, their temperature being so low that the steam is condensed on entering; and being expanded through a great portion of the stroke, from $\frac{8}{10}$ to $\frac{9}{10}$, the cylinder has no chance of getting heated after the very first admission of steam. Under these circumstances, with perhaps a cold draught of air passing along the backs of the cylinders, water of condensation has occasionally been formed to such an extent, as to fill up the clearance, and cause the piston to strike, although without lifting the escape valves. At such a time, when there is no reason to suppose the boilers are evaporating less than six or seven lbs. of water per lb. of coal, the indicator diagram will show as little as four and three lbs. Circumstances frequently occur in the navy, when vessels are obliged to go as slowly as possible, the engines just creeping over the centres. The condensation from throttling goes on, and fuel is wasted perhaps for many hours. As, under the present low-pressure system, expansion cannot be beneficially carried to an extent anything like commensurate with the slow speed required, it is much more economical to work with one engine and a moderate degree of expansion. This might be useful to keep in mind in planning new machinery. With the present engines, it would take too long a time, and too much labour, to disconnect one engine; and, besides this, there is the difficulty, not of getting the single engine to go, but of making it equally available with the pair, for quick stopping and reversing. The plan of using two cylinders to each engine, one of which may be disconnected, will meet these requirements, but the objections on other grounds are too weighty. If the objects which we have pointed out are to be attained with the full efficiency, at full speed, already achieved by the existing engines, one cylinder must suffice for each engine. There is material enough here for the consideration of every marine engine-builder.

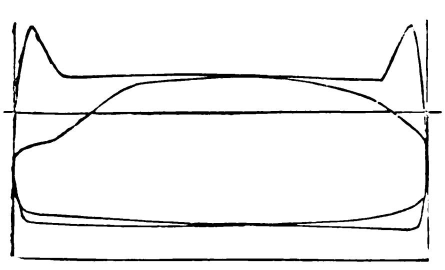
DAUNTLESS.
1st Step Expansion; Revol., 29½; Mean Pressure, 14·2 lbs.; H. P., 1175.



HIGHFLYER.
Revol., 53·4; Mean Pressure, 18·45 lbs.; H. P., 702.



ENCOUNTER.
Revol., 71; Mean Pressure, 13·9 lbs.; H. P., 638·6.



As the actual performances on which these remarks have been founded were witnessed, and carefully noted and weighed, by the writer, we may reasonably trust that the deductions will be received with the confidence due to the straightforward reasoning of a practical observer.

THE PATENT LAWS.

A bill has just been introduced into Parliament for the purpose of substituting stamp duties for the fees payable on passing patents, and also to provide for the purchase, for the public use, of certain *Indexes* of specifications.

The bill provides that the act, and the *Patent Law Amendment Act*, 1852, are to be construed as one act. The first portion of the bill is almost explained by its title. It consists simply of provisions for substituting stamps for the money fees now payable, and is an extension into the patent law, of the system already introduced into the Court of Chancery.

By the *Patent Law Amendment Act*, 1852, the commissioners were directed to cause indexes of all specifications to be made for the public use. The present bill recites that such specifications exceed 15,000 in number, and that several years would elapse before such indexes could be completed, but that Mr. Bennett Woodcroft has already made such indexes, which have been examined by the commissioners and approved of by them, and that it is expedient that such indexes should be purchased for the use of the public. It is, then, proposed to obtain power to purchase Mr. Woodcroft's indexes at a sum not exceeding £1000, the purchase-money to be paid out of the moneys received and paid into the Exchequer under the *Patent Law Amendment Act*, 1852. After the purchase has been effected, the indexes are to be treated as the indexes directed to have been purchased by the *Patent Law Amendment Act*, 1852.

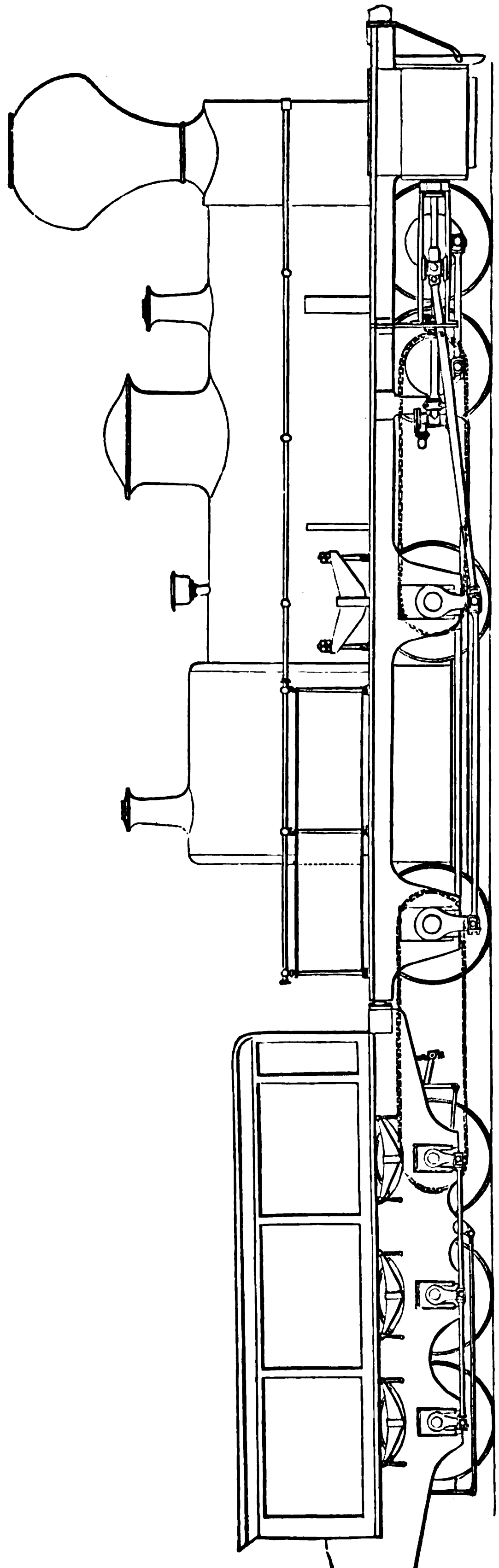
We cannot but approve of the objects of this bill, as, at present, an inventor has no means of ascertaining, with any degree of certainty, whether his invention is novel, or otherwise; and very large sums of money are annually expended upon patents for subjects that have been patented—in some cases we could readily refer to—three or four times before.

We would, however, suggest to the commissioners, that their efforts should not be restricted to the mere acquisition of these indexes. Such valuable compilations should be at once printed and disseminated through the public libraries in all our large towns, where they could be readily referred to by inventors, and the commissioners should allow copies to be sold at a moderate rate. If, as is at present the case, these indexes are confined to the Great Seal Patent Office, and a fee of 1s. for each subject is exacted—the object of the officer being to exact as many shillings as possible—the purchase will really be a useless expense. We look forward hopefully to a new state of things with regard to these matters. Hitherto every obstacle has been thrown in the way of an inventor desirous of information as to what has previously been done. In future, we trust that every information is to be afforded to him.

Whilst upon this subject, we may refer to the progress of the working of the new patent law. The number of applications for patents under it, appears to have astonished every one. In the first three months, just concluded, no less than 1,000 petitions have been lodged, and provisional protections obtained; whilst, during the same period of last year, only 130 distinct applications were made.

In opposed cases, the difficulty which we anticipated from the first, with regard to the value of the provisional protection, has now arisen. It is, that it is nearly impossible for the petitioner to prove whence his opponent derived his information, and at what period he first possessed it. In the course of our own practice, we find much dissatisfaction arises to all parties in the case of opposed cases; and the only way in which an inventor can be perfectly safe, appears to be to refrain from publishing his invention in any manner whatever, until his patent is actually sealed,—the provisional protection being, in fact, of little, if any, value, except as affording a species of *locus standi*, and determining the question of priority of action, in attempting to obtain the benefit of the law's protection. In this, indeed, it follows the same course, and certainly confers advantages of no greater weight than were obtainable by the help of the *report* under the old law, but with the difference, that the new step costs but ten guineas, against eighty pounds formerly.

The law officers appear to be considerably confused as to their powers under the new act, and to treat some of the matters referred to them in a manner totally different to that of any other tribunal. We confess to have been greatly astonished a few days ago, in our appearing in support of a petition for a patent, to be informed by the law officer that, as the opposing party alleged fraud on the part of the petitioner, he could not entertain the case until that allegation was disposed of—this being before the merits of the case were at all gone into, and, in fact, before the law officer had attempted to satisfy himself that the petitioner and the opposing party's invention were in the slightest degree similar. Such decisions must inevitably weaken the confidence of the public in the provisions of the law, and the mode in which they are carried out.



"Bavaria" Locomotive Engine and Tender, coupled to drive with fourteen wheels, for ascending steep Inclines.

3-16th inch = 1 foot.

THE AUSTRIAN PRIZE LOCOMOTIVE "BAVARIA."

The London and North-Western Express Locomotive, which we introduced to our readers last month, as an illustration of what the engineers of the nineteenth century are doing in this country for the improvement of railway speed, and, we may faintly hope, punctuality, on our lines of comparatively "bowling-green" level, may fitly bear as a pendant a much greater "curiosity of mechanism," now at work in Austria, on one of the rugged and mountainous lines of that empire. This is the "Bavaria" locomotive, the triumphant winner of the prize offered by the Austrian Government for the engine of most satisfactory performance on the Semmering line, between Gloggnitz and the place with the almost unpronounceably spelled name of Murzzuschlag. This prize was the large sum of 20,000 ducats, a ducat being equal to nine shillings and twopence of our money; and the test was an actual trial on the line, in the terms laid down in the following heads of the trial regulations:—

"1. The whole length of the Semmering Railway from Gloggnitz to Murzzuschlag is 24·354 English miles; the distance from Gloggnitz to the highest point on the Semmering mountain is 17·14 miles, with a rise of 1-40th nearly the whole way, and curves varying from 933 to 622 feet radius; the descent of the incline from the Semmering mountain to Murzzuschlag is 7·214 miles, with the decline and curves of the same nature as the incline.

"2. The weather on the Semmering ranks amongst the most inclement of the Austrian realm.

"3. The locomotive must pass through the sharpest curves at the velocity of 18 miles per hour, without a load; and, after the engine has attained that velocity, it must be brought to a stand in a space of 498 feet. The engine that cannot do that without slipping off the rails, will not be allowed to compete for the prize.

"4. The locomotive must be capable of transporting a load, in the ordinary state of weather, of 138·12 tons at least, exclusive of engine and tender, over the several gradients of 1-40th—the most unfavourable curves not excepted—at a regular speed of 6·76 miles per hour.

"5. The weight on each wheel must not exceed 6·9 tons.

"6. The boiler-plates must be one-half inch thick, neither more nor less; and the diameter of the boiler must not be more than 3 feet 8 inches, without it can be sufficiently stayed in proportion to the diameter.

"7. The pressure of steam per square inch is not to exceed 117·6 lbs. above the pressure of the atmosphere.

"8. The width of the line is 4 feet 8½ inches.

"9. The engine must not exceed in no part the width of 9 feet 4 inches.

"10. The burning material is wood; and the chimney must be constructed to extinguish the sparks, and the height must not exceed 15 feet 6 inches from the rails.

"11. One pump must be capable of furnishing the boiler with water.

"12. The locomotive will be tried on one mile of the railway between two stations; the experiment must be repeated at least 12 times; at the most 20 times, out of which 12 courses must be successful—that is, to be capable of ascending the rise of 1-40th at the velocity of 6·76 miles per hour, with a load of 138·12 tons, exclusive of engine and tender.

"13. If two engines were alike for speed and consumption of fuel, then the one that has more power will be preferred."

At the outset, seven competitors stood forward to contest the prize. The celebrated Belgium firm of Cockerill sent the "Seraing;" the Wien-Gloggnitz Company contributed the "Vindobona;" Herr Gunther, the "Wiener-Neustadt;" Herr Maffei, of Munich, the "Bavaria;" and to these are to be added four English houses, which drew back, however, before the trial came off. There thus remained four engines which actually entered the lists.

Each of these had its essential peculiarities. The "Seraing" had eight driving-wheels, with four cylinders, and was "bogie"-like, to suit the curves. The "Vindobona" had also eight driving-wheels, actuated by two cylinders only, and with a fixed or non-"bogie" frame. The "Wiener-Neustadt" had eight driving-wheels, and four cylinders, with a moveable or "bogie" under-carriage, and no tender; but, instead thereof, two long sausage-like cisterns running along the upper portions of the sides of the engine. Of the "Bavaria," the fortunate winner, we have a complete set of very beautifully-executed drawings now before us, so that we are enabled to enter more minutely into the particulars of its construction, in reference to the accompanying longitudinal outline of engine and tender.

The "Bavaria," then, is built from the designs of Mr. Joseph Hall, a Newcastle engineer, now of Herr Maffei's Iron Works at Hirschau, and who has been already twice a contributor to our pages, in his "Oscillating Marine Engines, with Link-Valve Motion,"* and his "Marine Engines on the Upper Danube."† The "Bavaria's" boiler is of the usual tubular kind, but of gigantic dimensions, the barrel being 14 feet 6 inches in length, and 5 feet in diameter, with 230 2⅛-inch tubes. It is carried on eight wheels, and the fire-box is situated between the first or main drivers and the hind or trailing driving-wheels, thus affording a large amount of room for a large fire-grate. The framing is double, all of wrought-iron, and the steam cylinders are bolted horizontally to the outside frame, immediately behind the front buffer beam. Connecting-rods, 10 feet 3 inches long, extend back to outside cranks, 15 inches long on the main driving-axle, just in front of the fire-box; and the pins of the same cranks carry a second pair of connecting-rods of 9 feet 8 inches in length, passing to similar outside cranks on the hindmost axle of the

* Page 80, Vol. I., *Practical Mechanic's Journal*.
† Page 169, Vol. III., *Practical Mechanic's Journal*.

engine, under the driver's foot-plate. In this way, the cylinders, which are 20 inches diameter, and 30 inches stroke, actuate four driving-wheels directly, by a combination of direct connecting-rod action and a simple coupling. The remaining four wheels support the front end of the engine in a "bogie" frame, and these wheels are also turned into drivers by a stout endless pitch chain, actuated by a chain pulley keyed on the centre of the main axle, in front of the fire-box. This chain drives the hind axle of the bogie pair by means of a similar pulley; and wheels on this axle carry crank-pins for a pair of 3 feet 9 inch coupling-rods, extending forward to similar pins in the leading wheels. This completes the coupling system of the eight engine wheels. But, not content with this, the designer has added the six wheels of the tender to the list of drivers, thus obtaining the adhesive traction of fourteen wheels. A second pitch chain and pair of pulleys serve to connect the hind axle of the engine with the leading axle of the tender, and the series of six wheels here are again connected by coupling-rods and nine-inch outside cranks in the usual manner. The wheels are 3 feet 6 inches diameter. The boiler is fitted with two lock-up safety-valves, in addition to the usual Salter's balance-valve for the driver. The boiler plates are double, riveted together by stout and broad encircling hoops, ⅜ inch thick; and, in addition to this source of strength, each plate is encircled at its centre by a strong hoop of bridge, or internally recessed section, to take the strain off the rivet joints. The area of fire-box surface amounts to 123·72 square feet, including the cross sections of the tube ends and fire-doors, as taken above the level of the grate bars. The fire-grate area is 25·22 square feet; and the tube or "carried heat" surface presents an aggregate of 1840 feet. The engine is fitted with the link-valve motion, the links being suspended from the bottom, and worked in the usual manner; and, in addition to the four eccentrics required for this duplex action, two others are used for the adjustable cut-off for expansion. The expansive arrangement is on the "right and left screw" principle, originated by Mr. Bodmer, each screw on the cut-off valve-spindle having its own separate solid slide, the two being made to govern a pair of ports passing right through the steam slides. The degree of expansion is variable by means of a small winch-handle fast on a spindle running along outside the boiler, and connected in front by a cross shaft and bevel pinions, with the two cut-off spindles, an indicator being fitted up at the handle, to show the state of the slides. The chimney, of course, terminates in an enormously expanded pear-shaped head, nearly 5 feet in diameter at its bulge. This acts as a spark-catcher, in conjunction with an arrangement of the inner chimney, which is covered by a solid inverted cone-piece, and has radial side openings for the draught current.

The engine itself weighs 48·8 tons in working trim, and the unloaded tender is equal to 12·2 tons more. When put to work, it made several trips with a gross load of 261 tons up the incline of 1 in 40, and along the severe curves of 622 feet radius. The average rate was 12 miles an hour under these circumstances. At another trial, a gross load of 283·2 tons was carried at 9 miles an hour; and Mr. Hall adds that he is prepared to take 338 tons at the same speed. Another report says, "The 'Bavaria' drew 2,600 cwt. at the rate of 2½ German miles per hour, and when the umpires had descended, she went for four minutes at the rate of 3·8 miles an hour."

The court of arbiters was formed of an Austrian employé, belonging to the department of Public Works; a gentleman connected with the Northern Railroad; a Bavarian; and a second foreigner. The former president of the Austrian committee in London, the Chevalier de Burg, acted as president of the court of arbiters. The chief engineer, M. Pilarsky, a Pole, has had to contend with very great difficulties, but the road will be open to the public in 1853. The outlay, up to the present time, is rather more than seven millions of florins, and the total expense will be eleven millions.

The array of pitch chains, pulleys, and connecting-rods of the "Bavaria" will somewhat shock the notions of English engineers; but they must remember the peculiarities of the service to be undertaken, and the low speed required. The details of the engine are for the most part extremely creditable.

THE NEW CRYSTAL PALACE.

On leaving London by the London Brighton and South Coast Railway, upon the right hand, running up by the Sydenham station, is a road leading in a westerly direction towards Sydenham and London, and joining the road from London to Croydon. A little farther on the line of railway is a bridge, over which, also on our right, is a road to Norwood, also running into the London and Croydon road, while midway between these two roads the railway crosses the high road from London to Bromley. The property purchased by the Crystal Palace Company is comprised within the boundaries of the latter and the road to Norwood; and the Palace itself is being erected on the high ground upon the western extremity, contiguous to the London and Croydon road, and will thus have all the frontage possible upon the line of railway. Perhaps no spot could have been chosen more eligible for the purpose. The grounds are park-like and well drained, and many fine specimens of timber trees adorn them, not a few of which have already been levelled to make way for the splendid structure, which is destined to be unparalleled, at least for some time to come. While the builders have been hard at work, they who have the furnishing forth of the interior have not been idle; howbeit the labours of the latter must as yet rest principally upon hearsay. The builder is not satisfied with this, and already, by his thousands of iron columns surmounting each other in many tiers, begins to claim his wonted primary admiration. We say admiration, rather than any other sentiment, for it seems to us totally impossible to pick a way through the business and bustle of the scene that is at present exhibiting on the spot, and not to admire, with every freshness of feeling, the beautiful and appropriate conception of Sir Joseph Paxton, and the great resources of our nation towards realizing that conception. If the design contemplated be carried out—and with such a man as the chairman of the directors, and such a staff of artists, &c., whom he has secured, there is no doubt of it—the intended building, in itself, will be a far more wonderful mass of iron and glass to look upon than was that interesting one in Hyde Park. The directors have done well in publishing some little sketch view of the entire external structure; and a lithographed ground plan, aided with colour, now lies before us, from the press of Messrs. Day & Co. But suppose we enter the building from the park on the basement floor. Well, here we are, and are admitted to Sir Joseph Paxton's tunnel, extending the whole length, from the extreme north to the extreme south, affording a private means of more ready access to the separated portions of the edifice, than it will be possible otherwise to obtain when it is "furnished forth" as proposed. Ascending a flight of stairs, we come upon the ground floor. Let us begin our perambulation at the north entrance. The vista that will here meet the eye must as yet be left to the imagination alone. But some idea of it may be formed, when a circular nave, several feet higher than the transept of the building in Hyde Park, extending from one end to the other, and lined with groups of statuary, interspersed with every variety of native and exotic foliage, will meet the gaze, relieved by complete masses of water, and elegant bridges connecting the eastern and western sides. The first court entered is the Byzantine, Romanesque, and Norman, in which several tombs, with mosaics, founts with figures, and a ciborium, will be found, besides many other matters, plastic and graphic, indicative of the interesting periods. From this we pass into the Mediæval Court, which is not likely to come short of the splendour which lent such attractions to the court so named in 1851. Here again will be tombs, together with impressions of the Great Seals of England, a fine statue of England, and cases of ivories and enamels. But the most distinguishing feature will be the cloisters at the north and south sides, which cannot but give a character to this department before wholly wanting. The idea of these cloisters is one of the many we find, but have not space particularly to notice, stamping the order of workmasters appointed to direct the operations, by showing all the marks of genius required in arrangements of this kind. In the Elizabethan, French, Flemish, and Renaissaure Court, next arrived at, are to be exhibited models of art which have never yet appeared but where they were originally placed. The same may be observed of the Italian and Revived Classical Court, which is next on our way. At the transept, another magnificent form of the Crystal Palace building will be objected to the eye, which will here be relieved by a beautiful fountain, and the stored treasures of tropical vegetation. We are then to pass southward through courts devoted to silks and shawls, woollen goods, flax and hemp, and printed fabrics, until we arrive at the southern extremity, which will here again present the appearance of a large winter garden, with its appropriate fountains, statues, &c. Passing over to the western side, we may enter one of the grand refreshment-rooms, which is to be constructed and fitted up in every particular as a complete restoration of a patrician's domicile in the palmy days of the fated Pompeii, with its compluvium and the surrounding cubicula, the tablinum and its alæ, and an interesting peristyle leading to the triclinium. We thence pass through the courts, counters, and spaces destined to be devoted to the exhibition of mineral manufactures, one court being devoted to Sheffield and another to Birmingham. Then on through the furniture, carpets, paper-hangings, to the stationery and fancy goods—again to the transept; passing through which, and through another phase of vegetable growth, we enter the great Nineveh Courts, which will contain models of every interesting sculpture discovered and sent to Europe by both M. Botta and Dr. Layard. The winged bulls and lions will here preserve their original relative positions in the building, and will consequently furnish a much better idea of the remarkable ancient

palace from which they were taken, than can possibly be obtained by one who has not visited the actual site. The same remark will even more strongly apply to the next in rotation, the Egyptian Courts. If M. Bonomi's views are carried out, we may hope that some of those wonders, which are visible now only in Upper Egypt, will be put in such a form before the rudest imagination, as to leave little to be desired; while models of the more extraordinary of the remains—including the enormous Sphinx, now in the Louvre—will be properly placed to make a due impression of their colossal proportions, and the peculiarity of the genius and taste which originated them. The Greek Courts, which we are then to tread, will exhibit everything of importance to be known about the wondrous architecture and sculpture of that wondrous people. They will enclose many statues and bas-reliefs, with early and late vases, and a large coloured model of the Parthenon. The transition from Greek to Roman art is almost as rapid as the passage from the one court to the other; and in the Roman Court we are promised, as in the other departments, full-sized models of objects of antiquarian research most worthy of attention. Thence we enter the second great Refreshment Court, which is to form a complete "double" of a portion of the royal palace of Alhambra, comprising the court of lions, with the celebrated fountain, and the hall of justice, with its marvellously designed and executed roof, in all their rich barbaric splendour. Passing hence across the nave, and over one of the bridges, we ascend a staircase to the galleries, in which, among articles too numerous to particularise, will be found the precious metals, clothing, substances used as food, musical instruments, cutlery, philosophical instruments, china, glass, leather, furs, &c. While here, as on the ground floor, in different parts, open corridors and galleries may be traversed, from most of which very beautiful views of the surrounding park, gardens, lawns, terraces, and country scenery, will be obtained. All the machinery, quiescent and in motion, is to be placed in the basement, and will form, if report speaks truly, in this, as in the last great Glass House, a prime attraction. Some magnificent fountains, whose play of waters is to rival that of the best at Versailles, are to ornament the gardens surrounding the building, and the world-famous Cleopatra's needle—which is now about to be brought from its ignoble position at Alexandria—will necessarily add a feature to exterior decorations of the highest interest. In addition to the above, we understand that great advances have already been made in forming the zoological, ethnological, and raw produce collection, which will form altogether mainstays of the institution, as a resort for educational purposes. We wish the Company every success in their now no longer doubtfully successful speculation, but regret to learn that obstacles have been placed in the way of their obtaining what they are most strictly entitled to, a charter of incorporation; the law not permitting such charter to be granted for establishing any place of entertainment into which entrance-money is paid on Sundays. The resources of the Company are twofold—a palpable, but not readily punishable, evasion of the forbidding statute, or an application to Parliament for an express private law, limiting the responsibilities, as is most just, of the shareholders of this noble undertaking, and enabling them to throw open their principal treasures to purchasers of Sunday tickets.

Since writing the above, we understand that Messrs. Owen Jones and Digby Wyatt have returned from their long tour of discovery in Europe, and have fully realized the purpose of their journey, having in all the continental capitals received the best assistance in making the various intended collections of more general interest. It is particularly gratifying to know, that every person whose attention is professionally directed to further the interests of the Company appears to be doing so with an enthusiasm which commands, as we are persuaded it will receive, complete success in the many coming years, from which we may have reason to look back upon the original promoters of the startling scheme, as amongst the most intelligent and clear-sighted of their countrymen, and the best benefactors of their race.

BAGGS' STEAM STAMPS FOR CRUSHING ORES.

(*Illustrated by Plate* 114.)

In this apparatus, the patentee, Mr. Isham Baggs of London, has applied the principle of the direct action of steam, developed in earlier times by Watt, and worked out and modified in later years by Nasmyth and Condie, to the special purpose of crushing refractory matters, like gold quartz and metallic ores—a purpose for which the arrangement is admirably suited. The two views in plate 114, represent the modified hammer or stamp under two aspects—a front elevation, and a transverse or side vertical section. The base-plate, A, rests at its centre, immediately beneath the line of the stamping action, upon the end-wood, B, placed there as a deadening substratum. This base-plate carries the holder for the anvil, or stamp surface, C, and has bolted down upon it the pair of vertical side standards, D, which support the actuating steam cylinder, E, and act as guides for the traverse of the weighty hammer, or stamp, F. The steam cylinder is, in this example, 6 inches in diameter, and 18 inches stroke. It is cast with a stout bracket, G, by which it is bolted down, in an inverted position, upon the tops of the standards. The metallic piston, H, is attached to its rod by a nut and back cotter, the rod passing out through a stuffing-box, and having a collar, I, on its lower end for attachment to the stamp. This collar is imbedded in a recess on the upper side of the stamp, upon the top of a few layers of wooden discs, placed therein to diminish the shock on the connections, and cut off the direct jarring from the steam cylinder and framing. Wood is also placed in the recess above the collar, and held down by a metal ring or collar near the top of the recess. The chest, J, of the slide-valve, for the regulation of the steam admission and escape, is cast with a small open-topped bored cylinder, K, on its upper end, and this cylinder has a piston, L, fast on a prolongation of the slide-valve spindle—the inner or lower side of this piston being open to the steam in the valve-chest. The slide spindle passes out through an inverted stuffing-box, and its end works through a fixed guide-collar, M, and terminates in a slotted link-piece, N, through which the short arm, O, projects from its stud centre, P, this arm being in one piece with a heavy pendant lever, terminating in a forked double eye, with a loose pulley, Q. In the position shown in the plate, the steam, entering by the pipe, R, fills the slide-chest, and passes by the lower port into the bottom portion of the cylinder, E. This elevates the piston, carrying up the stamp with its hammer-face, T; and the curved piece, U, bolted to the stamp, then comes in contact with the inner side of the pulley, Q, pressing the lower end of the pendant lever outwards. This draws down the slide-valve, and reverses the steam ports, so that steam passes into the cylinder above the piston, and brings down the stamp with a smart blow, in addition to the gravity of the piece, F. During this movement, the arm, O, is eased off the bell-crank, V; a rod, W, from the opposite arm of which, passes down to a short bent lever, X, set on a fixed stud on the frame beneath. Then, as the stamp falls, the inclined piece, Y, upon it, presses out the inner projecting end of the lever, X, and restores the arm, V, above, to its original position, to form a stop for the arm, O, of the pendant lever. All this time the steam pressure is acting on the lower side of the small piston, L; so that, on the release of the pendant pulley from lateral pressure, the steam elevates the slide-valve to the position given in the plate, for a fresh up-stroke. The machine is obviously capable of easy adjustment for varieties of work. Its powers are to be measured by the fact, that a 4-horse machine crushes 20 tons of ore or quartz per day; and in a trial at the Spitty Copper Works, in Wales, 40 tons of coarse metal were disposed of in 12 hours—26 tons being reduced to fine powder, whilst 14 required a second passage beneath the stamp, the masses being originally of the size of paving-stones. One of the machines is now at work in London, at the establishment of Messrs. Johnson & Matthey, Millwall. From the simplicity of parts, and quick action of the apparatus, it may be expected to be very generally adopted for crushing all kinds of refractory minerals.

BELTZUNG'S SCREW-NECKED BOTTLE.

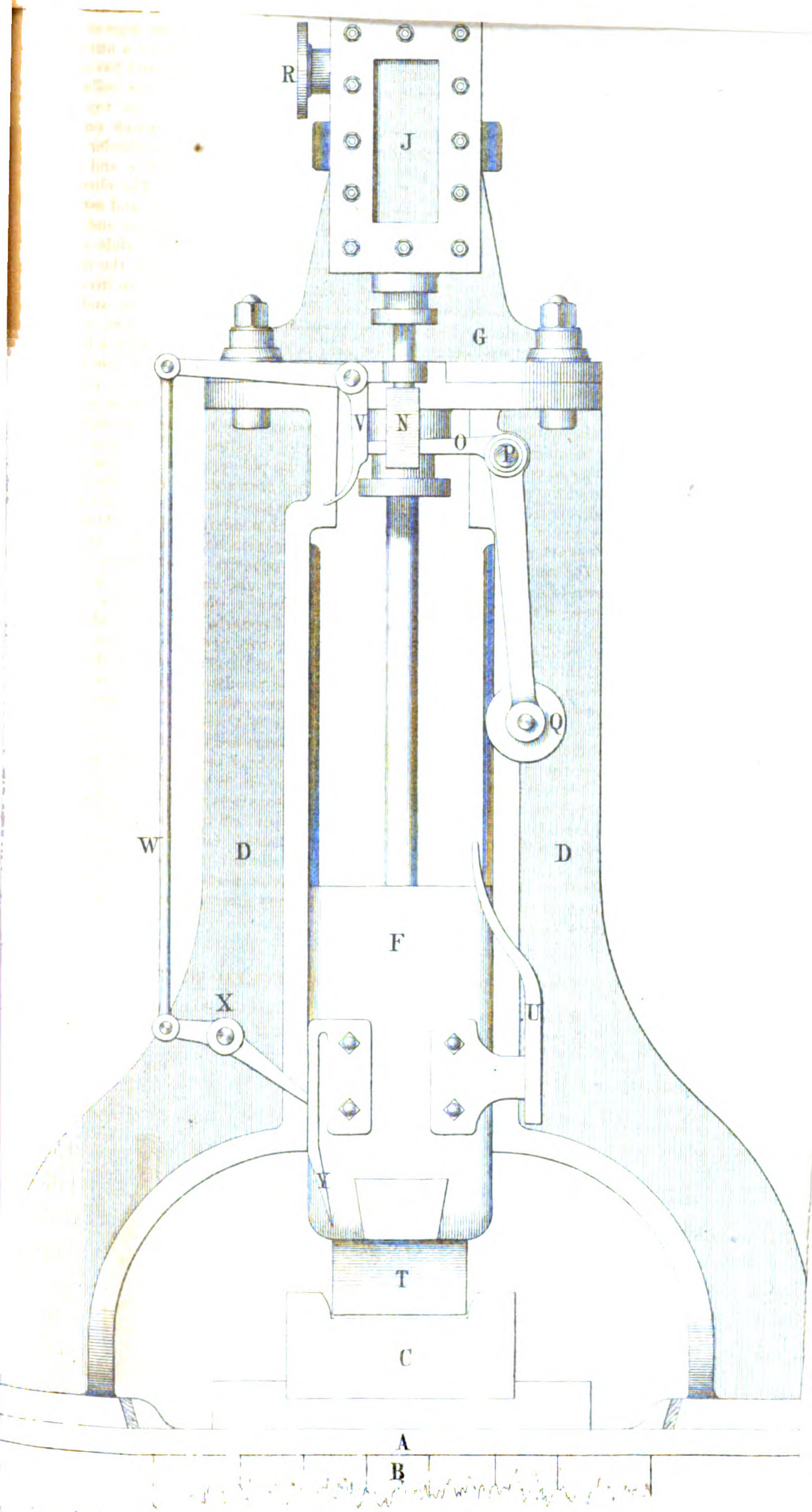
We have already briefly noticed this invention,* on its appearance as a "Recent Patent;" but as the new bottle is now the veritable manufacture of the licensees of "Beltzung's Patent Bottle Company," we are

Fig. 1.

Fig. 2.

Fig. 3.

* Page 207, *ante*.

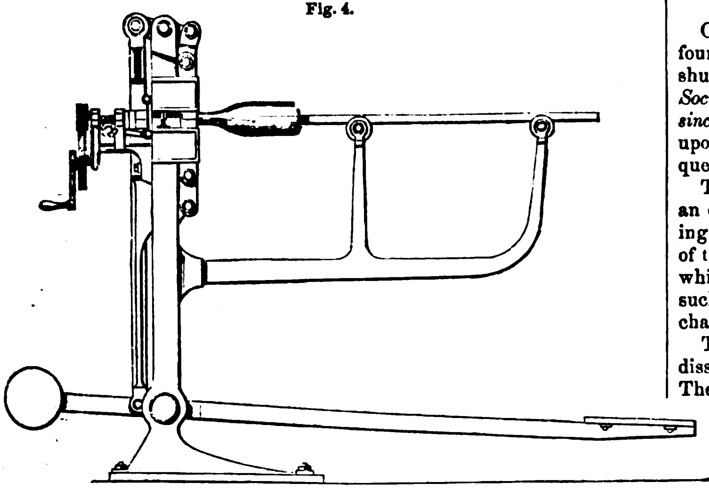


FRONT ELEVATION.

now enabled to illustrate and discuss the improvement to an extent somewhat corresponding to the apparent value of the project.

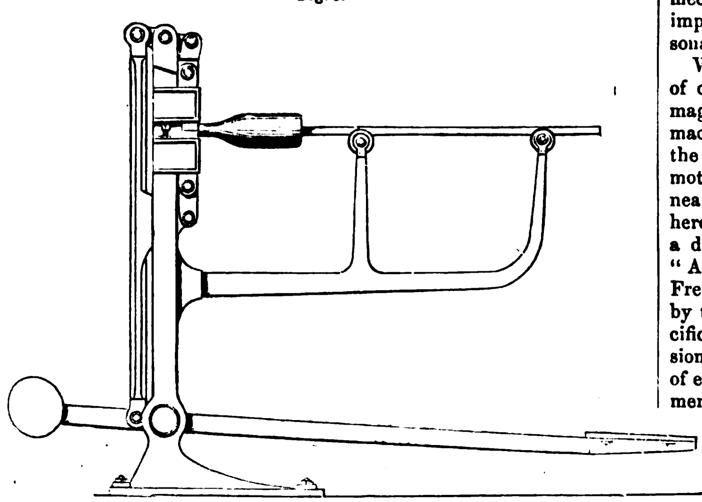
The three leading figures of our engravings will afford some idea of the reality of the contrivance. Fig. 1 is a view of the stoppered bottle, complete; fig. 2 is a similar view of the bottle, with its screw-cap in the act of being put on; and fig. 3 shows the bottle with its cap removed. The object of the invention, as we need hardly explain to the readers of this *Journal*, is the formation of a screw-thread on the exterior of the bottle neck, in the very process of the bottle's manufacture, without any expenditure of time or increase of labour, and consequently without any additional expense. Many attempts, spreading over the last fifty years, have been made to attain this object; but their universal failure is a matter of history. In some, the breakage was so excessive as to involve ruinous expense. In others, the irregularities in the screw-thread, or in the size of the neck, were more than sufficient to neutralize the presumed advantages of the system—so that, up to the present time of writing, stoppers of this kind have never been made on a scale at all commensurate with the spirit of commercial enterprise of the nineteenth century.

Fig. 4.



External screws have long ago been cut on bottles suited for the elegance of the dressing-case, and for the inconsiderable uses where expense was a minor consideration. But the importance of the plan before us consists in the fact, that the moulding process, as incorporated with the actual

Fig. 5.



shaping of the bottle, adds nothing to the cost of production of the finished article.

The stopper caps, which may be made of gutta percha, copper, tin, or zinc, or alloyed metals, are manufactured by a single blow of a common fly-press, in conjunction with a "presser die," the cost being absolutely less than that of good corks. Fig. 4 is a side view of the machine employed for making the screw on the neck, by a combination of dies, with an expanding mandril, actuated by a treadle. The dies are brought together by the depression of the treadle, whilst the mandril is made to revolve in the interior of the neck. Fig. 5 is a similar view of the machine, with a solid mandril. This is the form of machine chiefly used, as the expense of an extra hand for turning the back gear in the expanding plan is here rendered unnecessary.

When a cork has once been perforated with a cork-screw, it is useless; and every one has felt the annoyance of being unable to suit an empty bottle with a good well-fitting cork. But the screwed cap remains with its bottle, and, with ordinary usage, is as lasting as the bottle itself, the recess of the cap having a thin layer of cork in it, to secure a satisfactory tightness of bearing. When we remember also, that the consumption of cork has for some time far exceeded its production, it is some satisfaction to show that a good substitute has arisen. The screwed bottle has already found its way into the market, and is being made on the Tyne, at Glasgow, in Yorkshire, and Gloucestershire.

THE SOCIETY OF ARTS' EXHIBITION.

One of the most interesting sights of the season has just opened its fourth anniversary in its quiet quarters in John Street, Adelphi, just shut out from the noise and bustle of the busy Strand. This is the *Society of Arts'* "*Collection of Articles Invented, Patented, or Registered, since October*, 1851," which this year exhibits a marked improvement upon its preceding shows, and fully substantiates its position as an eloquent claimant upon the attention of the observant classes of our time.

The idea—and a most admirable idea it is—of thus placing before us an expository record of the development of invention during the preceding twelve months, became a substantive fact in 1848; the special object of the Council being, to afford facilities for determining the direction in which inventive men were working, and to insist on the importance of such a possession as a permanent *Museum of Inventions*, as an eloquent chapter in the history of the ingenuity of the age.

This—the initial Exhibition—gave us, as its chief features, practical dissertations on *Electric Telegraphs, Paddle Wheels, and Screw Propellers.* The second at once burst into higher ranges and wider fields. It produced exemplifications of *Railways and their Mechanism, Pressure Guages, Gas and Water Meters, Looms and Spinning Machinery, and Electro-magnetic Motors.* The third year went further and deeper into mechanical construction, and brought with it many valuable novelties in sanatory matters, and contrivances of a domestic nature; with improvements in agricultural and horticultural mechanism, and the application of steam power to such purposes.

The present Exhibition is arranged under six principal heads:—1. Motive machines, including railway mechanism; 2. Manufacturing machines and tools; 3. Building contrivances and materials, and naval and military mechanism; 4. Philosophical instruments and hardware; 5. Agricultural implements and saddlery; 6. Miscellaneous, including articles for personal use.

With the neat and quaintly printed catalogue as a guide for the order of our notes, we come first upon a set of well-executed working electro-magnetic machines, by M. Froment of Paris. In his direct rotatory machine, the inventor has ingeniously contrived that each magnet of the series shall begin to act when its keeper is close to it, the keeper motion being effected by an eccentric. The same inventor also shows a neat vibrating engine of this class. Mr. Siemens' water-meter is also here *de facto*, under several forms and sizes; and Mr. Kennedy has sent a drawing of his "Reaction balance meter." Mr. Crockford has an "Alcohol meter," a new form of an instrument founded on the late French discovery, that the boiling point of alcoholic fluids is regulated by the amount of contained alcohol, without reference to the fluid's specific gravity. In the early form of the meter, the boiler for the immersion of the thermometer was open, so that, long before reaching the point of ebullition, some of the alcohol was dissipated, and hence the experimental results were seriously vitiated. Mr. Crockford has got out of this difficulty by adding a condenser, to condense the alcohol as it rises, and throw it again into the boiler, preserving the alcoholic mixture in its normal condition. The rise of the mercury in the thermometer is elegantly contrived to tell the tale of the alcoholic presence. Vidi's *aneroid* guage is here, under a new form, the elastic chamber being in the shape of an elastic-ribbed metal pipe. It is well made, and mechanically arranged.

Messrs. W. & J. H. Johnson contribute no fewer than eight mounted coloured drawings, of very fair execution, including—

1. Mr. M'Connell's "London and North-Western express locomotive," as built by Messrs. E. B. Wilson & Co. of Leeds.
2. Modern locomotives by contemporary builders:—Messrs. Wilson's

"Jenny Lind," Hackworth's "Sanspareil," Fairbairn's tank engine, and England's "Little England."

3. Recent patented inventions:—Siemens' "Prussian state telegraph," Kennedy's "Water-meter," Kufahl's "Prussian needle-gun and needle-revolver," Jacobs' "Sixteen-colour calico-printing machine," and the "Coltness furnaces," showing Mr. Houldsworth's plan of utilizing the waste gases of blast-furnaces, in the calcination of the ironstone.

4. A similar composite sheet, showing—Coleman's "India-rubber bearing springs, draw springs, and buffers," M'Connell's "Wrought-iron steam cylinders, pistons, and axles," Paterson's "Cop-winding machine, with self-acting build," Wright & Hyatt's "Elliptic cylinder rotatory engine," and Siemens' "Rotatory balance water-meter."

5. Recent improvements in textile machinery:—Macindoe's "Self-acting mule, with lever putting-up motion;" Dickinson & Willan's "Power-loom, with engaging and disengaging loose reed;" and Milligan's "Power-loom, with self-regulating taking-up motion."

6. Gathercole's "Envelope folding, gumming, and embossing machine."

7. Martin's "Horse-hoe, as applied for hoeing turnips;" a very capital machine, to be drawn by horses, and arranged to work two or more drills at once, with a simple adjustment for any variety of work.

8. Fulton's "Self-fitting ventilator hat," an ingenious invention, fully described elsewhere in our present part.

This series forms a very interesting group to the right side of the room on entering.

Messrs. Thornton & Sons have a "Railway roof lamp," in which the air for combustion is carried down from the outside of the carriage roof, through a tube, forming, at the same time, one of the burner arms. The air so conveyed is delivered into the centre of the glass globe, whence it rises to the flame, conferring a cooling effect upon the lamp details. Messrs. Wagstaff & Co. send a "Railway pocket-candle lamp," a compact little "Palmer's candle," with spring adjustment, fitted into a tin tube for pocket conveyance. The miserable light usually afforded in railway carriages, is so severe a punishment upon all who, like ourselves, like to read when on a long journey, that we are certain this contrivance would be joyfully accepted by the literary traveller, if the inventor could manage to find a convenient support for it; as far as we can make out from the lamp shown, it must be held in the hand during use. Mr. Simons has a series of seven varieties of miners' lamps, possessing many features of ingenuity. Mr. Lyon's "Machine for mincing meat," puts us in mind of the "willow" of our cotton-mills. It is in a rectangular case, 14 inches square, and may be screwed to the kitchen dresser. The mincing action is effected by a horizontal cylinder, having spirally arranged lines of pins upon it, which, as the meat is supplied from above, pass between a set of vertical knives, and quickly disintegrate the crude masses. The machine is most creditably made, and its toothed gearing works exceedingly well. There are no fewer than four "Gold-washing machines," besides several examples of gold-seekers' tools. Mr. Blashfield exhibits his very beautiful terra-cotta, under a variety of ornamental shapes. It is a new composition, burnt in the kiln without the usual "saggar," and is of fine texture, and apparently most substantial. Hartley's "Rolled plate-glass" is a most useful material. It is semi-opaque, and being produced in large sheets, it is well adapted for windows, instead of the small panes with metal framework, used in Gothic edifices. Nothing can be more beautiful, or better adapted for their purpose, than Mr. Froggat's "Ornamental panels," painted by a new process, or rather, a new adaptation of colour to decorative purposes. They are in a pale dull ground, with the floral or other ornament relieved from it, by being of a polished reflecting texture, and shadow lined. A great variety of examples are hung round the room, to which their chaste elegance contributes a fitting adornment. Mr. Mallet's "Buckled plate for covering roofs," is a simple and economical substitute for corrugated metal. The specimen shown is simply a rectangular plate, slightly dished, to give the additional strength obtained from the undulations of the old form. It is light and strong. Mr. Goddard's "Asbestos gas stove" gives out a very cheerful warmth, through its light feathery layer, laid upon the burners, and is highly successful in its sembled incandescence. Mr. Blashfield's "Terra-cotta gas stove," adjoining, is another example of the practical value of this elegant material. The gas is led in from below, and is burned beneath a hollow cone of fire-clay, which serves to diffuse the heat. This stove is extremely ornamental. It is unfortunate that the use of these stoves always involves the presence of so disagreeable an odour. Which of these examples is to blame, or whether both are equally culpable, we know not; but the atmosphere in their neighbourhood is extremely unpleasant. This fault must be repaired, if we are to look for the extension of gas fires.

Mr. W. B. Adams' "Combination pavement and flooring," is a cast-iron frame or recessed plate, filled in with wood, terra-cotta, or pieces of tile. It is capable of arrangement so as to present neat devices, and looks very serviceable. The respective plans of "Boat-lowering apparatus," of Mr. W. S. Lacon and Mr. H. Bridson, are represented by elaborate models and drawings. Captain Walker's "Deviation compass," and Mr. Maling's "Rifle barrel and balls," are both well represented. So also is Mr. Statham's "Piano-forte," a fine-toned instrument, illustrative of the application of metallic stops to the wrist-plank and sounding-board.

In locks, the American firm of Hobbs & Co., transplanted to Cheapside, shows the "solid key," and "permutating" kinds. Mr. Parnell, too, has his "defiance lock"—access to which is prevented by a solid cylinder of hard brass, having protecting wards extending the whole depth of the lock, with an aperture in the centre for the key, which is fitted with great nicety. The key has the appearance of a highly-polished "blank," and, in entering the lock, it fits on the edge of a steel plate, in the shape of an eccentric circle at the end of the pin. When the key begins to move, the bits corresponding to the levers are gradually forced out by its action round the eccentric plate, so that, on reaching the side detector, it has become slightly elongated, and when arrived at the levers, it has expanded one-third of its length, when it begins to move the bolt. Mr. Blyth exhibits a "manure distributor," made by Garrett. A shaft, with attached prongs, revolves in the manure cylinder, and, in so revolving, elevates tongues to scrape the prongs, and discharge the manure into a shoot; and to pulverise the manure still further, the shoot has in it alternate lines of wire. Messrs. Cogan & Co. show a very interesting collection of "dairy and horticultural glass." Amongst these is a glass churn and a churn thermometer—the latter being merely a tube and bulb containing mercury, and set to indicate the proper churning temperature. The same firm also shows some simple lactometers, and syphons for separating milk from the cream, and some glass pails, with gutta-percha handles and wicker-bottom shields. In harness, Mr. J. Penny has a very elegant "Victoria bridle," as an attempt at a new application of high art. Messrs. Lott, Jewell, & Co., have also a splendid set of harness, exemplifying the application of a slide clasp as a substitute for the common buckle, and dispensing with the usual tongue holes. Mr. Preller has a great variety of specimens of leather tanned by a new composition. The original web-like fibrous texture of the material is preserved; and, owing to its not being immersed in any tannic solution, the leather is of superior density and strength. A curious form of purse is shown by Mr. Benda. The body is a species of semicircular cup of india-rubber or leather—the open mouth of which is kept closed by the pressure of a pair of light parallel steel springs, pressure on the ends of which with the fingers at once bulges the springs at the centre, and lays open the recess. In Messrs. Coates' "Penetrating hair-brush," the rows of bristles are set in the block diagonally, and at right angles and acute angles alternately, giving a very powerful penetrating effect. Mr. Hyams has two very interesting cases of "thistle-down," illustrative of the application of this natural production to manufacturing purposes. One case is filled with the down as it is plucked from its parent stem, whilst the other contains a quantity in its prepared condition, for mixing with cotton as a substitute for silk. The prepared material has a beautiful silky appearance, as evidence of the value of the result, if the involved means are not too costly. Mr. Thomson shows his "Slush lamp," modified on the telescopic principle, having two tubes, one within the other—the inner one containing the wick, and the outer one purified grease, which is pressed up into the wick by the lower part of the tube. Mr. Emery also shows his improved basket-work, wherein a wooden bottom is combined with wicker-work sides and handles.

Such a collection is worthy of the Society, and the efforts of Professor Solly. It is naturally limited in extent; but within these limits it shows us what we have lately done, it illustrates what we are now doing, and, more than all, it tells us, in authoritative language, what we have yet to do.

MUNTZ' SOLID ROLLED BRASS TUBES.

"Muntz' Metal," patented just twenty years ago, is one of the most splendid of the existing examples of the commercial success of a very simple invention. If not a household, its name may indeed be said emphatically to be a workshop word. The compound itself is well nigh ubiquitous. Its practical usefulness it would be difficult to overestimate, even if we were to confine our view of it to sheathing and ships' bolts alone. We have been led into these remarks by the appearance of a novel process of manufacturing metals of this class, recently patented by Mr. G. F. Muntz, jun., the son of the earlier inventor. This is a mode of making solid brass or composition tubes by a system

of flat rolling. The composite metal which the patentee selects for his purpose, is one of 60 of copper and 38 of zinc—and he commences by casting a short thick tube of the transverse section, fig. 1; and so far the plan resembles the first stage of Mr. Green's ingenious manufacture. But Mr. Green "draws" his tube—Mr. Muntz "rolls" his. The casting is made in an iron mould, with a sand core, and when carefully cleared from the mould, it is heated to about 212°, and washed out internally with lime and water, saturated with salt; this treatment being necessary, to prevent adhesion of the contact surfaces during the after-rolling. The tube is then heated, and passed between a pair of rollers, similar to those used for flat bar-iron, but grooved, so as to produce rounded edges, as in the section of the flattened tube, fig. 2. The tube is rolled with its thick side horizontal, so that, whilst the metal is flattened down and extended in length, the sectional thickness is rendered uniform; and in this state the rolled elongated tube is like a flat empty sack, or an unopened glove-finger. One end of the tube is now opened, in a heated state, by a wedge-shaped or taper tool, to a length of about six inches, so that the opened portion is of the section shown in fig. 3. This opened end is then entered upon a fixed mandril, and is drawn over this mandril, by the action of the pair of rollers, fig. 4; and it is this drawing and rolling action which brings the whole tube to the actual section, fig. 3, a web or fin being produced at each side of the tube, by the opposed square surfaces on the rollers. These fins are then cut off, and the tube is then opened out to its true cylindrical section, by passing through the semicircular rollers, shown in fig. 4, a corresponding mandril being here substituted for the one previously employed. A red heat is employed in this rolling, and the tube is held and guided up to the rolls, with its longer axis upwards, so that the second rolling is at right angles to the first one. This guiding action may be performed by having a fixed plate before the rolls, with an oval hole through it, large enough for the free passage of the tube, the larger axis of the oval hole being vertical. This process of casting, rolling out flat, and finally opening, is really somewhat extraordinary. Naturally enough, many practical men have quietly decided that tubes could not be made in this way, under the pardonable impression that the metal could not bear the necessarily rough usage involved in that system. It is, however, a fact, that at the well-known works, French Walls, Birmingham, 16 feet tubes, of No. 12 wire-guage, are now regularly made and proved to 1000 pounds' pressure per square inch. The whole rolling process is gone through at a red heat, and three heatings only are required after casting.

Fig. 1.

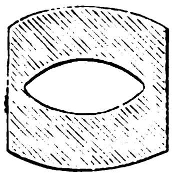


Fig. 2.

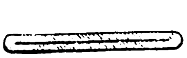


Fig. 3.

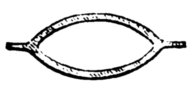
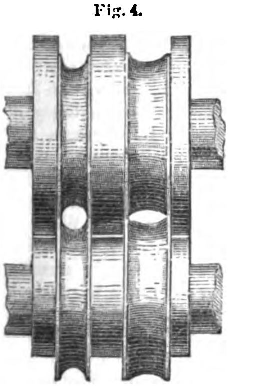


Fig. 4.



The patentee tells us that he secures the following advantages in his process:—1. Economy in first cost. 2. Superior durability, the metal being a compound, naturally hard, and not mechanically hardened, like ordinary brass tubes, so that the improved tubes are not liable to split or burst from the effects of thermal variations. 3. Equality of hardness throughout, the metal being sufficiently tough to bear expanding, when fixing in the boilers, without softening the ends—a necessary precaution in fixing the brass tubes previously in use, and involving increased wear. 4. Diminished liability to corrosion, in comparison with any mixture of brass, capable of being tubularly shaped by the usual process. We are assured that these tubes are now being regularly made. With this fact before us, we are not disposed to question the validity of Mr. Muntz' assumptions.

MECHANIC'S LIBRARY.

Architecture, A Series of Designs, Modern, imp. folio, £2 2s. Brooke.
Art-Journal for 1852, 4to, 31s. 6d., cloth.
Astronomical Vocabulary, 12mo, 1s. 6d., cloth, sewed. J. R. Hind.
Builder's Price-Book, 1853, 8vo, 4s., sewed. Skyring.
Designs for Cottages, 4to, 12s., boards. E. Aikin.
Differential Calculus, On the. 8vo, 14s. 6d., cloth. B. Price.
Drawing in Schools, Instructions for Introducing Elementary, 4s. 6d.
Electricity, On, Vol. I., 8vo, 18s., cloth. De la Rive.
Great Exhibition, Remembrances of, Second Series, coloured, 14s. 6d., cloth.
Growth of Plants in Glazed Cases, 2d edition, post 8vo, 5s., cloth. Ward.
Hydrostatics, Elementary, post 8vo, 5s. 6d., cloth. J. B. Phear.
Literary and Scientific Register, 1853, 32mo, 3s. 6d. Gutch.
Natural Philosophy, Library of Useful Knowledge, Vol. II., 8vo, 8s.
Navigation, 12mo, 2s., cloth, sewed. H. W. Jeans.
Science, Marvels of, 3d edition, crown 8vo, 10s. 6d., cloth. S. W. Fullom.
Tanning, Arts of, &c., 8vo, 28s., cloth. Fontenelle and Malepeyre.
Wheels, Theory of the Teeth of, royal 8vo, 10s. 6d., cloth. E. Sang.
Workshop Companion, 3rd edition, 12mo, 5s. 6d., cloth. W. Templeton.

RECENT PATENTS.

MANUFACTURE OF HATS.

ANDREW FULTON, *Glasgow.—Enrolled December* 10, 1852.

This invention has reference to certain modifications of the linings and internal fittings of hats or helmets, for the obtainment of an easy and pleasant fit, together with superior coolness and better ventilation than has hitherto been accomplished.

Mr. Fulton's simple and ingenious contrivances are represented in the annexed engravings—fig. 1 being a plan, and fig. 2 a vertical section of a hat constructed according to this patent. Fig. 3 is a perspective view of the lining detached. The lining, A, made of a size slightly less than the interior of the hat body, B, is suspended on a wire, C, which passes round the top, and is shown partly uncovered in fig. 2. This wire is supported by four or more flat strips of brass, D, fixed to the hat body at the bottom. In the intervals between the strips, D, are four or more other strips, E, soldered to the wire, C, and stitched to the lining, being covered, if desired, as at E, where the covering is shown partly unstitched. These brass strips act slightly as springs, and cause the lining to accommodate itself to the irregularities of contour of the head, whilst their disposition, in the manner shown, keeps the lining stretched, a fine wire or whalebone piping, G, being run round the bottom of the lining to assist in keeping it in shape.

Fig. 1.

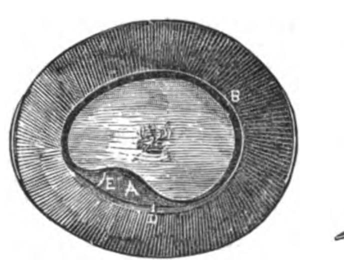
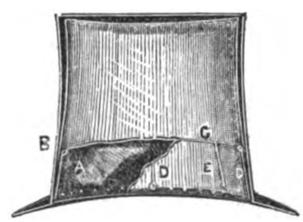


Fig. 2.



Perfect ventilation is provided for, by perforating the lining near the bottom, which, combined with the existence of a slight space between the lining and the hat body, fulfils this object very efficiently. The arrangement of brass supporting pieces is susceptible of various modifications. For instance, the supports, D, and stretchers, E, may be formed in one piece, as in fig. 4, the descending piece being a little on one side of the support, to allow of closer compression, or the descending piece may be duplex, as in fig. 5. In these figs., A A are front, and B B edge views of the springs, and the small holes indicate the manner of attachment.

Fig. 4.

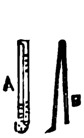


Fig. 3.

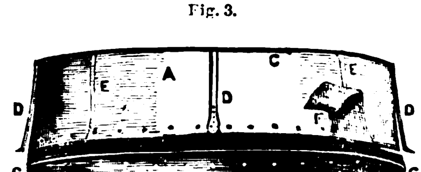
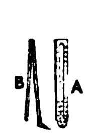


Fig. 5.



Slips of cork, vegetable pith, or other material, may be interposed between the lining and the hat body, to insure the suspension of the former from the latter, and at the same time allowing of perfect ventilation.

This arrangement of a loose lining affords an easy self-adjustment to the head, giving the hard non-fitting hat a perfect fit, like a soft cap, quite irrespective of the discrepancies between the shape of the head and the hat body, and doing away with the long-experienced disagreeables so antagonistic to the comfort of the wearer of the common hat. Many a throbbing temple will be relieved by Mr. Fulton's invention.

TREBLE CYLINDER EXPANSIVE STEAM-ENGINES.

J. H. Johnson, 47 *Lincoln's Inn Fields, and Glasgow.—Enrolled December* 28, 1852.—*(Communication.)*

This is a French invention of a novel mode of carrying out Wolf's system of expansion. Instead of merely expanding the primarily used steam into one other cylinder, Mr. Johnson's plan provides for the use of two or more low-pressure cylinders, with the view of securing a high degree of expansion, combined with uniformity of motive effect. For example, in a three-cylinder engine on this plan, the small high-pressure cylinder is placed between the other two, on a single base plate, the three being in one horizontal line. After working in the high-pressure cylinder, the expended steam from each stroke is conducted, by a peculiar arrangement of slide valves, to the other two cylinders alternately, and the crank-shafts of the three being geared together, the combined power of the series is developed in one shaft for communication with the machinery to be actuated. The high-pressure cylinder is of half the length of stroke of the others, and its piston is therefore so geared with the other two, that its crank shall make two revolutions whilst the other two make one. By this contrivance, the escape-steam from the high-pressure cylinder is made to work the two low-pressure cylinders with perfect regularity; for the escape-steam due to one single stroke of the small cylinder first passes off to work one of the larger cylinders, and then, on the change of the valves at the termination of the next single stroke, the waste-steam due to this latter stroke enters the other large cylinder. This is the action of the engine, the difference between the two rates of piston always bringing in the waste high-pressure steam at the right time for each low-pressure cylinder—the eduction steam from one stroke of the high-pressure cylinder being always discharged into one low-pressure cylinder, whilst the expansion of the previously discharged steam is going on in the other. The patentee shows several modifications of this plan, as applied to stationary and marine engines, and with combinations of oscillating and fixed cylinders.

REVIEWS OF NEW BOOKS.

On the Progress of Naval Architecture, as Indicating the Necessity for Scientific Education, and for the Classification of Ships and of Steam-Engines. Also, on Life-Boats. By Captain Washington, R.N., F.R.S. Bogue: London. 1852.

"Also on Life-Boats." This is a very odd way of introducing to the public what might, with very great propriety, be termed an Essay on Life-Boats; for the first portion of his labour is soon despatched, and what the author proposes to say "also on life-boats" is swollen out like the conventional postscript to a lady's letter, more than half the pages being taken up with this subject—perhaps, after all, deservedly so. Some matters, however, could not be left without one word. Sir William Snow Harris's "Admirable Lightning Conductor," and "the Satellite Compass," by St. John of Buffalo, come in for just so much notice; and the marvels that have been exhibited by steam-ships could not but be noted down as chief impressions of our times upon all time.

It is to the undaunted perseverance of Robert Fulton, an American, that the honour is due of having carried steam navigation into practical execution; and in August, 1807, he made his first passage from New York to Albany in the *Clermont*, of 20 horse power, at an average speed of five miles an hour. And we are reminded that, in 1818, a steam-ship crossed the Atlantic, from Savannah to Liverpool; in 1838, just twenty years later, the *Sirius* and *Great Western* made their first voyage to New York; and now, as it is well known, steam-ships of 2000 tons burthen and 500 horse power are navigating the Pacific and Indian Oceans; and they weekly cross the Atlantic at the average rate of ten miles an hour, whatever be the wind or weather; while American river steamers navigate the Hudson at the rate of twenty, if not two-and-twenty, miles an hour.

The contrast of speed between land and water locomotives claims a passing attention of the lecturer; and it certainly is singular, that, making every allowance for the difference in circumstances, this contrast should obtrude itself so much upon us—we hope to good purpose. With direct action and tubular boilers, we only get a power of about four horses for each ton weight of engine; whereas some of the larger locomotives exceed a power of 30 horses for each ton weight.

The lecturer then goes on to notice with reprehension the but recently abolished tonnage laws, which, as he says—quoting the words of Mr. Scott Russell—amounted in effect to an Act of Parliament for the compulsory construction of bad ships. "Need we," he continues, "wonder at the amount of shipwrecks? The startling fact, that about two ships a day, throughout the year, is the average number of wrecks registered at Lloyd's, is a sad corroboration of the acknowledged truth, that the mercantile navy of England has hitherto been the least speedy and the most unsafe that belongs to any civilized nation."

It was to the munificence of the Duke of Northumberland that we were indebted, at the Great Exhibition, for the display of models of life-boats of so great a variety; and it is particularly gratifying to know, that for the greatest improvements in their construction we are indebted to this noble President of the National Shipwreck Institution, himself a rear-admiral in the navy, and lately instated in the high office of First Lord of the Admiralty. His Grace offered a reward for the best model of a life-boat. The offer became heard in the principal maritime countries of Europe and America, and no less than 280 models and plans were sent in. Some fifty of the best of these formed the Duke's contribution to the Exhibition. We cannot refrain from completing the record of the princely generosity which the Duke has thus shown. A report on these models, accompanied by plans and drawings of the most approved of them, was prepared at the expense of his Grace, and 1300 copies of it gratuitously distributed, not only throughout the length and breadth of our island, but to all the maritime nations of Europe and the United States of America; in addition to which, his Grace publicly expressed his intention of placing the best life-boats that can be built, and every means for saving life from shipwreck, on all the exposed points of the coast of Northumberland.

It is gratifying to observe that many of the models were sent in by men who are earning their daily bread as working shipwrights or boat-builders. Let such know that they are ever cordially welcomed. The *working* man, if he be at the same time the *thinking* man, is the man for the age.

The author then enters particularly into details concerning the form, dimensions, materials, extra buoyancy, &c., of the life-boat, noticing, under distinct heads, their internal capacity for holding water, the means of freeing the boat of water, provision for self-righting, transporting, carriage, &c., and goes into some length on the subject of accidents to life-boats, and the necessity of training, and otherwise, into the existing modes of saving life, adding some pages upon rockets and mortars. The Northumberland Prize Model, by James Beeching, of Great Yarmouth, exhibited, perhaps, the best points, namely, "consistency of beauty of form with those qualities of speed, strength, stowage, and stability, which are essential in such structures." Although these qualities, as stated by the lecturer, appear to be everything desired, we believe some untoward accidents have lately occurred, which show that these presumed qualities are not to be entirely relied upon. We give an account of those qualities, as capable of assisting those whose attention may be drawn to the practical consideration of this most interesting subject. From the form of the model, the lecturer says, she would both pull and sail well in all weathers, would have great stability, and be a good sea-boat. She has moderately small internal capacity, under the level of the thwarts, for holding water, and ample means for freeing herself readily of any water that might be shipped; she is balanced by means of water admitted into a well, or tank, at the bottom, after she is afloat; and by means of that ballast and raised air-cases at the extremities, she would right herself in the event of being upset.

This portion of the paper is concluded with a suggestion for the establishment of the office of a Sea Coroner, to take into deliberate scrutiny and investigation cases of so-called accidents to life-boats, and wrecks in general, as the author's attentive consideration, as he says, impresses on the mind the painful conviction, that the greater part of the casualties that occur are not occasioned by stress of weather, but that they are mainly attributable to causes within control, and to which a remedy might be applied. This suggestion deserves attention in the proper quarter.

Two singular accidents are recorded, which we notice. At Scarborough, in 1836, the boat, in approaching the outside of the broken water, was caught by a heavy overlap of the sea, which turned her end over end, shutting up one of the crew inside, where he remained in safety, getting fresh air through the tubes in the bottom, and was taken out when the boat drifted, bottom up, on the beach. The other occurred at Winterton, in Norfolk, about the year 1829. In this case the boat swamped, and the crew saved their lives by taking refuge on board the vessel they went to aid.

We cannot do better than conclude our notice of this work with some very pertinent observations of Captain Washington, on the important subject of naval education. We cordially sympathise with his views on this subject, and we cannot doubt that they must be entertained, in all their force, when but once they are placed before the attention of those whose influential position may best enable them to appreciate and act upon them. He says—

"We are invited, in the letter to the Society of Arts conveying his Royal Highness's suggestions for these lectures, 'to state freely, and without reserve, our opinion up-

the probable immediate effect of the Exhibition on the particular subject of each lecture.' What may be its effect with respect to naval architecture, and naval affairs in general, it would be difficult to predict; but one thing is certain, that the Exhibition has brought into striking relief the want of union between science and practice, the want of more intimate communication between scientific and practical men, and has shown the mischief likely to arise if the wall of separation be not broken down. Not only is this true in naval architecture, but it is equally true as respects the want of elementary instruction of our naval officers. As steam advances, we must give a mathematical education to those who are to command steam-ships, or we shall be left far astern in the race. What is the education now afforded to youngsters entering the navy? A name without the substance. They may by chance pick up some navigation when the other duties of a ship will admit of it; but as to any systematic instruction, it is out of the question; the very nature of the duties on board an active ship forbids it, however desirous the captain may be to forward it. The result is, that when a few years later the boys come, as men, to study steam, it is no uncommon thing that they have to begin with decimals and the elements of algebra. How are we to maintain our ground with neighbouring nations, where a cadet is kept, for the first two or three years after entering the navy, strictly at his studies? I do not advocate the re-establishment of the Naval College on shore, but I would earnestly recommend some plan or other, by means of which boys can be educated. Why not a naval school on board a line-of-battle ship, moored at Spithead, where systematic instruction in mathematics—the groundwork of a knowledge of steam—and practice in the earlier part of seamanship, might be combined? Unless something of this sort be done, I fear, as steam advances, this country will be left more and more in the background."

Illustrated London Drawing-Book of Practical Geometry, for the Use of Schools and Students. London: Hebert. 4to.

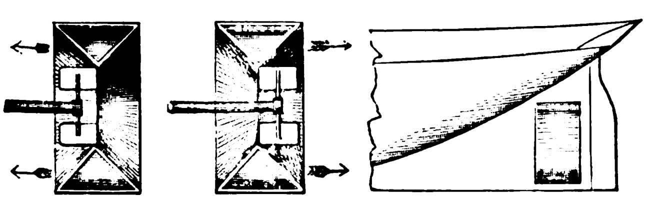
It is unquestionable that a stir is taking place in English thought with regard to elementary instruction of all kinds. Our present masters in drawing and engineering are expressing themselves sensible of the difficulties through which they themselves struggled in their earlier career, and are endeavouring to get rid of, or at least smooth, those difficulties for the youngsters shooting up around us. A want in this particular has been long felt; but it is only since the great year 1851, that this want has obtained some definite shape. It is, however, a law, that a want is almost immediately attended with relief. The exceptions which obtrude themselves in this as in other matters, only prove the truth of the rule; and here we have the example of a supply to an imperative demand. Ten pages of double-columned letterpress and twelve plates, comprising 186 figures, for one shilling! This is an attempt to meet the want experienced, which certainly is deserving of encouragement; and for mere tyros, who are just commencing the use of their attention in drawing, no doubt these pages will prove a considerable boon. They contain a short introduction to the subject, an exposition of certain definitions and constructions, and a large number of problems adapted for the young mechanical draughtsman, with solutions readily obtainable by means of a drawing-board, a T square, compasses, and parallel ruler. Our readers will at once perceive that the work is of the most elementary class, and that there remains still a desideratum for those, now amounting to many thousands, who, between the ages of sixteen and twenty-one, are occupying their time in the offices of civil engineers, architects, &c., and who require some yet more advanced treatise, in order to enable them, by grasping its contents, to render themselves more efficient in their present duties, and which may open the prospect to them of higher and more profitable and important studies.

CORRESPONDENCE.

NOVEL MARINE PROPELLER.

There have been many attempts to propel vessels by instruments on the principle of a centrifugal fan. They have all been unsuccessful, chiefly, I think, on account of the accompaniment of excessive friction through pipes or channels. A plan of obviating this having occurred to me, I beg to offer it for insertion in your widely-read *Journal*.

I would have the propeller—a simple centrifugal fan—placed in the dead wood, as customary with the screw, and as shown in the accompanying sketch.



Sections. Elevation.

Round it, and fixed to the dead wood, is a conical drum, with the widest part towards the stern; and the intention is, that the water thrown outwards by the fan shall be deflected sternwise by the interior oblique surface of the cone, at the same time communicating part of its momentum immediately to the cone, and through it to the ship.

In order that the ship may back, the conical drum must be duplex, as shown in the sections, and the shaft must be capable of longitudinal traverse, so that, when the fan is drawn into that half of the drum which has its widest part towards the bow, the ship will be made to go astern.

The duplex conical drum is surrounded by a cylinder, to lessen the external friction; and the fan and its speed must be so proportioned, that in a given time as great a quantity of water shall pass through the narrow part of the drum, as a disc of the diameter of the widest part would come in contact with, if drawn through the water at the rate the ship is made to go; the object of this being, to lessen the friction which the forward part of the drum would otherwise meet with in being drawn through the water.

Goose Quill.

Glasgow, December, 1852.

ELLIPTIC ROTATORY ENGINES.

In the December part of the *Practical Mechanic's Journal*, a description is given of Messrs. Wright and Hyatt's rotatory engine, the peculiarity of which consists in the working chamber being bored elliptically. Some four or five years ago, I invented a rotatory engine on precisely the same principle. You will doubtless be able to confirm this statement, since I forwarded you a sketch and description of my plans.

Though unable myself to carry out the invention, I shall still take much interest in the progress of this unique little engine, and hope you will at some future time give your readers some account of its further performances.

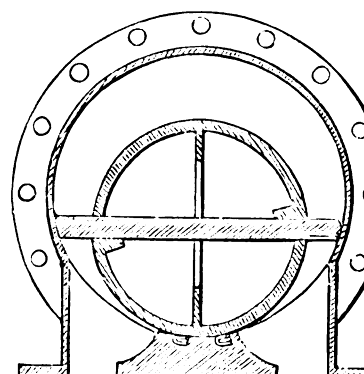
Edmund Hunt.

Glasgow, December, 1852.

[Our correspondent is correct. We have amongst our papers more than one sketch of the elliptic arrangement, bearing his signature. The communications were not sent to us for publication, so that they never appeared in our pages. But we have now much pleasure in acknowledging and publicly stating the quarter whence the idea first reached us.—Ed. *P. M. Journal.*]

ELLIPTIC ROTATORY ENGINES AND METERS.

The December part of the *Practical Mechanic's Journal* contains a plate and description of an engine of this class, on which I shall be glad to offer a few remarks, by way of pointing out that the peculiar characteristic to which you have referred as being involved in such engines, has not been wholly unknown amongst practical men—having, indeed, been carried into effect, in the form of a water-meter for large consumers, since April, 1848. At the Leeds Water Works we have about twenty-four of this class in daily use. They are made entirely of brass, and are consequently expensive; and, at high velocities, there is a recoil or reaction, which makes them noisy. With these two exceptions, the contrivance answers well as a fluid-meter.



In January, 1849, I sent a meter, with half-size drawings, to the Society of Arts, in competition for the prize-medal offered at that time for the best meter. These drawings were never returned, and were said, on inquiry, to be lost. What became of them I cannot conceive, but I never could get them back. The annexed sketch is a transverse section of the meter as originally made. The alterations since introduced refer merely to an increase of strength, as the principle has been left untouched since the first.

Joseph Adamson.

Drayton Manor, Hunslet, Dec., 1852.

[Our answer to another correspondent on this subject will show, that we were in possession of the theory in question a very considerable time back. We also knew that elliptic meters had been made; but it appeared to us that the perfection of the movement had not been carried out in such meters—nor had the theory of its action been thoroughly understood, as great reliance was placed on elastic packing for filling up the area of the piston's path. Mr. Hunt first drew our attention to the beauty of the movement, and explained the peculiar characteristic, which we still believe to have been quite unlooked for amongst practical men.—Ed. *P. M. Journal.*]

CAPTAIN NORTON'S PROJECTILES.

Amongst the inventions of Captain Norton which you noticed in your last number, I think you will allow that there are some which are scarcely so well worthy of attention as his "elongated expanding bullet." With these may certainly be classed his concussion fusee (No. 9 of your illustrations), which has a loop of slow-match passing lengthwise through it, to the lower end of which match is firmly attached a musket bullet. This bullet, it is said, "on firing the gun, holds its place till the shell strikes the object, when it starts from its place, carrying the burning match into the shell, and exploding it." Now, it is evident that this will take place whenever the shell receives a shock sufficient to dislodge the bullet; and if this be not on the explosion of the charge in the gun, when the shell receives its maximum velocity, it certainly will not be on its striking the object after that velocity has been diminished, by the resistance of the air and the effect of gravitation. If such a fusee acted at all, its effect would be to explode the shell at the muzzle of the gun, and most likely to kill some of the gunners.

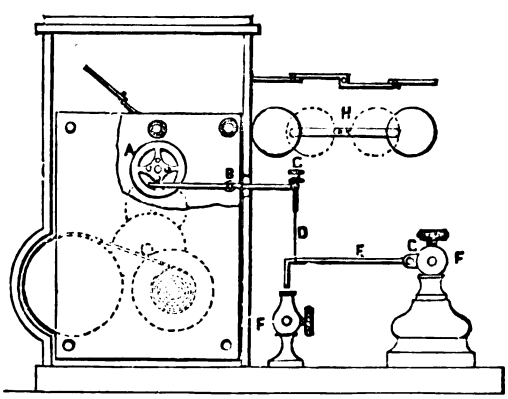
Oudeis.

London, December 13, 1852.

MITFORD'S GALVANIC CONTACT-BREAKER.

As a simple mechanical contact-breaker—free from the inconveniences of battery, magnets, mercury, and commutation wheels—must be of some importance to medical galvanists, I send you a sketch of the arrangement of which I have so frequently spoken to you. I invented it in 1844, and, since 1845, it has been in constant use here by Mr. Ruck, the medical galvanist at the Montpellier Baths. My drawing represents the original machine, as made out of an old eight-day clock. It goes for two hours after winding up. Fig. 1 represents the apparatus in side elevation,

Fig. 1. Fig. 2.



with one side of its case removed. The four-pinned tappet wheel, A, is driven at a uniform rate by the clock train, and as each pin comes round, it depresses the end of a lever oscillating on a fixed centre, B. The opposite end of this lever carries a regulating screw and nut, C, from which a loop of silk, D, passes down to the contact lever, E, so that, after the passage of each pin in the wheel, A, the weight of the contact lever elevates the free end of the lever, B C. The binding screws for the two wires are at F. The contact lever works on a joint at G, instead of a spring, and this requires less power than the latter plan. The angular end of the contact lever, E, and the striking part of the corresponding binding screw, should each be faced with a small platinum disc. Fig. 2 exhibits side and edge views of the fly, H, of the train of wheel-work. The arm of this fly carries a pair of jointed discs, which may be turned round on their respective centres of motion, to allow of the variation of the clock's rate. It must be obvious, that, had the works been made for the purpose, the apparatus might have been compressed to half the size, so as to be quite portable for the pocket.

I have also succeeded this summer in making a mechanical agitator for electrotype purposes, and have employed it successfully in my amateur pursuits. My decomposition trough is 15 inches square, and 18 inches deep, and the agitator fills up half this content, leaving a clear space of 7 inches × 15, and 18 in depth, for electrotyping use. The agitator works 15 hours with one winding up.

Bertram Mitford.

Northumberland Lodge, Tivoli,
Cheltenham, Dec., 1852.

THE NON-CONDUCTION OF SOUND BETWEEN SEPARATE APARTMENTS.

I have been called upon to take some method of preventing the noise in a room overhead being heard in the room below, the ceiling of which cannot be broken into. A false ceiling must therefore be resorted to; and I suppose the question is, what article introduced between the two ceilings would best produce the desired effect? The horse-hair felt used round steam-boilers has been tried without effect.

Information on this point would greatly oblige,

An Old Subscriber.

December, 1852.

AERIAL NAVIGATION.

Two improvements in the steam-engine, described in the last number of the *Practical Mechanic's Journal*, suggest the idea that the time has arrived when a successful attempt may be made to navigate the air by steam-propelled balloons. The compactness and simplicity of the elliptic rotatory engine of Messrs. Wright & Hyatt, and the extraordinary steam-generating power of Mr. M'Connell's new locomotive, together with a means of *entirely annihilating the weight of the fuel* required—to be described hereafter; and the possibility of condensing steam without a jet of water, by means of Ericsson's discs of fine wire-netting, which (if the accounts of it received from America be correct) would obviously *rob steam* of its caloric, in passing through it, *as well as air*,—seem to present the means of overcoming the difficulty hitherto insurmountable in atmospheric navigation, viz., the construction of an engine of sufficient power in proportion to its weight.

1st. If the "superiority of trusting to direct radiant heat, instead of carried heat"—and the arrangements to that end in M'Connell's new boilers, have effected so great an improvement as to raise the steam to the same pressure in one-fourth the usual time—it would appear that a boiler one-fourth the size, so constructed, will have steam-generating power equal to those now in use, or nearly so, *i.e.*, the weight of the boiler may be reduced to one-fourth what it has hitherto been.

2d. The great saving of weight in the other parts of the engine, by Messrs. Wright & Hyatt's elliptic cylinder engine, is obvious.

3d. I would propose to use a condenser formed of extremely small and flattened tubes, so arranged as to allow the current of air to pass between them, and the steam to pass into them through wire discs similar to Ericsson's. I am aware that this sort of condenser has been tried before, but I conceive that, with the addition of the wire discs, and by helping the condensation at starting by plunging the condenser in ice, (the water of which, when melted, could be sprinkled over the condenser to cause evaporation, the rapid motion through the air, after a high speed was attained, keeping it sufficiently cool for the remainder of the journey), this description of condenser could be made available, and, consequently, alcohol could be used in the boiler.

4th. It is suggested that, by using hydrogen gas (coal gas) for fuel, no weight whatever, on the score of fuel, need be calculated for. But it must be admitted, that the *bulk* of the machine would be greatly increased (and consequently the resistance), if an extra quantity of gas, over and above that necessary for the flotation of the entire load, has to be taken up—sand being, of course, thrown out as the gas was consumed. There is, however, another method by which, I think, this can be effected; that is, to adopt a combination of the two principles of flotation by gas and flotation by the resistance of the atmosphere to the under surface (an inclined plane) of the balloon, in the same way that a bird is supported in the air, and which was the principle of a machine invented some years ago by Mr. Henson. By this plan, the balloon, at starting, would ascend to a great height in the atmosphere (by means of the gas which is afterwards to supply the fuel for the whole of the journey), from which it descends again gradually, as on an inclined plane, until it becomes balanced by the increasing resistance of the air: the velocity of the machine through the atmosphere increasing as the resistance presented by its bulk diminishes, by the collapsing of the gas-bag as the gas is consumed. I take it for granted there would be no difficulty in making the silk collapse into a compact form.

As it is not improbable that a rate of 100 miles an hour could be attained, the distance between this country and America could be traversed in 36 hours. The great objection to balloon travelling, if ever it be accomplished, will no doubt be, the uncertainty as to time; but the time lost by unfavourable weather will be spent on shore, or before starting, instead of on the voyage, and when the weather shall have permitted the voyage to be undertaken, the distance will be travelled over in one-tenth of the time.

W.

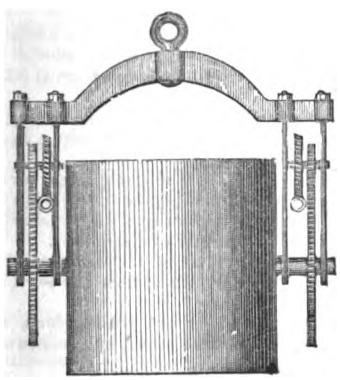
IRON-FOUNDERS' CASTING LADLES.

I am an iron-moulder by profession, and am, therefore, naturally interested in the consideration of any practical means of preventing the occurrence of the fearful accidents from the use of crane ladles, which every engineer and founder occasionally meets with. If the following remarks and suggestions seem to you to possess any real weight, I am sure that I cannot better convey them to the eye of the public than through the pages of the *Practical Mechanic's Journal.*

From frequent conversation with my fellow-workmen, and others conversant with the trade, I am fully persuaded that a general opinion prevails, that if a ladle is geared there is nothing to fear—an opinion which, on more than one occasion, my experience has proved to be incorrect; and from the fact, that great mechanical power can be obtained by the screw and wheel, there is very little regard paid to the resistance it has to overcome, and as little to the size and proportions of the machinery.

From what I can learn of the sizes in use, it appears to me highly probable that many are strained far beyond the limit of safety, though they, for a time, may not break. It is also apparent to me, that many persons who are intrusted with the making or gearing a ladle, have not leisure or inclination to investigate the subject, but content themselves with working it by "rule of thumb," or copying, with modifications, those they have seen. Such being my views, and believing that nothing has been published on the subject, I hope I may be allowed to offer the results of many experiments made in 1843–44, at which time I imagined I was the first who had applied the motion, with a view of obtaining data on which to construct and manufacture the apparatus. I subsequently learned that I had been forestalled. The ladles employed in the experiments in question were cylindrical, the depth being equal to the diameter; but others of the following shape and proportions were in all cases adopted in practice:—

Fig. 1.



The top or mouth of the ladle is elliptical; the minor axis = 1; the major = 1·3; the bottom circular, its diameter = 1; and the depth of the ladle = 1. The right lines joining the circular bottom with the elliptical top or mouth, form the figure of the ladle. The journals were fixed in such position that an equal amount of power was required to capsize, or to prevent the capsizing of the ladle. The position of the journals for the cylindrical ladle was found to be at $\frac{5}{8}$ths of the ladle's depth from the top, and $\frac{3}{8}$ths from the bottom; and for elliptical ladles, at half the depth. The empty ladles were balanced by counter-weights, so that their centres of gravity were brought in a line with the journals. Under these circumstances, I found that to adopt, as far as practicable, a uniform proportion, and to work with the ease, safety, and regularity I consider necessary, it required for all ladles up to 5 tons, the diameter of the screw-wheel to be ·8 of the ladle's diameter; the pitch, $1\frac{1}{2}$ inch, and the radius for the hand-wheel, or handle for the screw, 9 inches. For ladles from 5 to 12 tons, a wheel and screw for both journals, having the same proportions as the preceding; the two screws to be worked simultaneously. For ladles from 12 to 24 tons, I think some arrangement like that shown in fig. 1. The pitch of the screw and length of handle are necessary as before; the pitch of the spur-wheel $1\frac{1}{2}$ inch; its diameter ·8 of the ladle's diameter; and the screw-wheel or spur-pinion to be made such a size as will produce an effect equal to a screw and wheel, the ratio of the wheel's diameter to the ladle's diameter being found by the following formula:—

Fig. 2.

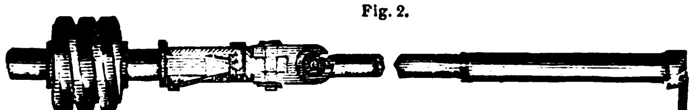


Fig. 3.

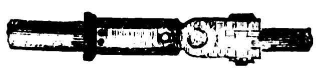


Fig. 4.

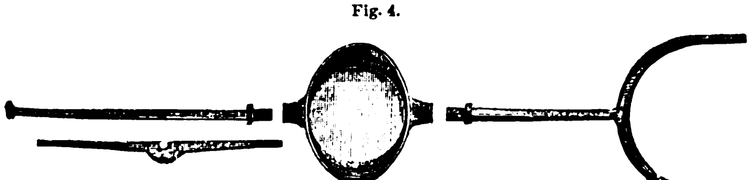
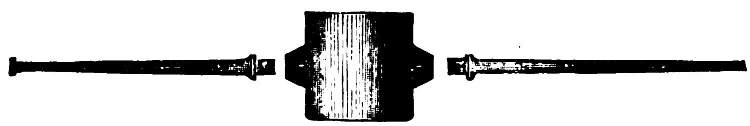


Fig. 5.

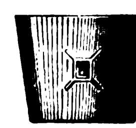


$$\frac{1188,\ \text{ladle's contents in lbs.}}{2513\cdot75} = \text{ratio of screw-wheel's diameter to ladle's diameter.}$$

By way of explanation, I may state that, in all the above-mentioned cases, the screw is supposed to be of wrought-iron, the screw-wheel being cast with concave teeth to suit the screw. All the wheels to have solid plates instead of arms, and all the machinery to be enclosed in sheet-iron casings, to prevent the possibility of melted iron splashing among the teeth. The rod or rods to which the hand-wheels or handles are attached, are from 10 to 20 feet long, a universal joint being made on the end to ship into the screw's axle, as in figs. 2 and 3, thus allowing the ladle to be hoisted or lowered, or any other motion to be made with it, without disturbing the men that are working it, who can, therefore, secure a wide berth, and be free from any annoying heat, and from the chance of becoming confused under such circumstances, when, for perhaps a second or so, all considerations are absorbed by the impulse of self-preservation.

In applying the form and proportions adopted in the construction of crane-ladles to the common double-shank or hand-ladles, I substituted the arrangement shown in figs. 4, 5, and 6, for the ordinary method of shanking them, with a view to obviate the great inconvenience of the shanks becoming bent, which is occasioned by the hoop carrying the ladle becoming hot. The alteration answered every expectation, not having the slightest trouble with them for years. By driving out the cotter, the shanks can be fixed to another ladle directly, besides many other conveniences which will be directly obvious to the practical man.

Fig. 6.



If the foregoing, which is based on experiment and calculation, with a wide allowance for contingences, be considered of any use, and the moulder be thereby enabled to follow his hazardous calling with less risk, I shall consider myself amply repaid for the trouble the subject has cost me.

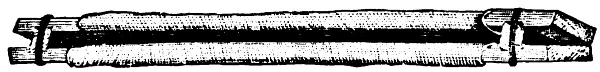
HECTOR SHORT.

Poplar, London.

[Mr. Short's remarks are, at any rate, well-timed. We have lately had a series of accidents of the very class to which his letter so pithily refers. Only the other week, the papers told us that a frightful accident took place on the premises of Messrs. Mare & Co., the engineers, which caused the loss of one life, and fearful injury to twelve of the workmen. It appears that the chief portion of the men engaged in the large foundry were preparing an immense casting. About twelve tons of the red-hot liquid iron was let out into a very large ladle, which travels on wheels, and while a great number of the workmen were conveying the ponderous mass of metal to its intended destination, one of the wheels suddenly broke, upsetting the liquid among the mechanics and labourers, scalding and burning their feet, arms, legs and faces, and various parts of their bodies. Such catastrophes may well startle us, and make us look about for the means of prevention. Our correspondent sets an admirable example to his fellow-workmen.—ED. PRACTICAL MECHANIC'S JOURNAL.]

PENCIL-SHARPENER.

Should you deem a description of my simple pencil-sharpener worthy of insertion in the *Practical Mechanic's Journal*, its appearance will probably oblige many readers, who, like myself, are in the habit of using the pencil. The instrument is nothing more than a strip of fine sand or



emery paper, fastened between two small parallel slips of wood, retained at the proper angle by two end wedges, held in position by winding a thread over them, as indicated in the sketch. In putting the apparatus in working order, one wedge is first fastened in its place, and the paper is then drawn down to form an angular trough, when the other wedge may be fastened. The operator then sharpens his pencil by inserting its point in the paper trough, and then drawing it towards him, at the same time twisting the pencil between the fingers to preserve the rounding action. Such a sharpener points the pencil without in any way soiling the hands of the artist.

F. H. S.

London, December, 1852.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INSTITUTION OF CIVIL ENGINEERS.

SESSION 1852-53.

The Council have this year awarded the following premiums:—

1. A Telford Medal, in silver, to Captain Mark Huish, Assoc. Inst. C. E., for his paper "On Railway Accidents."

2. A Telford Medal, in silver, to Braithwaite Poole, Assoc. Inst. C. E., for his paper "On the Economy of Railways."

3. A Telford Medal, in silver, to Colonel Samuel Colt (U. S. America), Assoc. Inst. C. E., for his paper "On the Application of Machinery to the Manufacture of Rotating Chambered-breech Fire-arms, and the peculiarities of those Arms."

4. A Telford Medal, in silver, to Frederick Richard Window, Assoc. Inst. C. E., for his paper "On the Electric Telegraph, and the principal improvements in its construction."

5. A Telford Medal, in silver, to Charles Coles Adley, for his paper, entituled 'The History, Theory, and Practice of the Electric Telegraph."

6. A Telford Medal, in silver, to Eugène Bourdon (Paris), for his "Description of a new Metallic Manometer, and other instruments for measuring Pressures and Temperatures."

7. A Telford Medal, in silver, to Pierre Hippolyte Boutigny (d'Evreux), for his "Description of a new Diaphragm Steam Generator."

8. A Telford Medal, in silver, to George Frederick White, Assoc. Inst. C. E., for his "Observations on Artificial, or Portland Cement."

9. A Council Premium of Books, suitably bound and inscribed, to John Baldry Redman, M. Inst. C. E., for his paper "On the Alluvial Formations, and the Local Changes, of the South-Eastern Coast of England, from the Thames to Portland."

10. A Council Premium of Books, suitably bound and inscribed, to William Thomas Doyne, Assoc. Inst. C. E., and to Professor William Bindon Blood, for their paper, entituled "An Investigation of the Strains upon the Diagonals of Lattice-Beams, with the resulting Formulæ."

11. A Council Premium of Books, suitably bound and inscribed, to George Donaldson, Assoc. Inst. C. E., for his paper "On the Drainage and Sewerage of the Town of Richmond (Surrey)."

12. A Council Premium of Books, suitably bound and inscribed, to Professor Christopher Bagot Lane, Assoc. Inst. C. E., for his "Account of the Works on the Birmingham Extension of the Birmingham and Oxford Junction Railway."

13. A Council Premium of Books, suitably bound and inscribed, to William Bridges Adams, for his paper "On the Construction and Duration of the Permanent Way of Railways in Europe, and the modifications most suitable to Egypt, India, &c."

The Council have issued the following modified list of subjects, on which, with others, they invite communications for premiums:—

1. On the principles upon which the works for the improvement of river navigation should be conducted, and the effects of the works upon the drainage and irrigation of the district.

2. The construction, improvement, and maintenance of natural or artificial harbours and docks, with the forms and action of large sluices for clearing away deposits, by the use of backwater, or by directing the natural currents.

3. The selection of sites for the construction of docks on the course of tidal streams, with reference to communication with railways and with inland navigation.

4. The selection of sites for, and the principles of, the construction of breakwaters and of harbours of refuge; illustrated by examples of existing works.

5. The forms and construction of piers, moles, or breakwaters (whether solid or on arches), seawalls, and shore defences; illustrated by examples of known constructions, such as the Cobb wall at Lyme-Regis, &c.

6. The best system of forming artificial foundations, showing the ratio of pressure to surface, and the soil best calculated to sustain heavy structures; illustrated by the best examples in modern practice, and by accounts of the failures of large works.

7. The relative value of various kinds of natural stone, available in Great Britain for the purposes of construction; with experiments on the law of increase of the crushing force of short blocks of stone, with their diameters.

8. On brick and tile making, and the capability of introducing new forms for engineering and architectural purposes; with the processes most useful to emigrants and settlers.

9. The laws of the strength of cast and wrought iron, under the various conditions of tensile, compressive, transverse, torsional, impulsive, and other strains; with examples illustrative of the coefficients employed by eminent practical authorities in the construction of works.

10. The construction of girder bridges, whether of trussed timber or wooden lattice; of cast-iron, trussed or plain, or combined with wrought-iron, in simple or compound triangulation; of wrought-iron lattice work; or of plate-iron riveted sides, with cellular top and bottom.

11. The construction of suspension bridges with rigid platforms, and the modes of anchoring the stay chains.

12. The comparative advantages of iron and wood, or of both materials combined, for the construction of steam vessels, with drawings and descriptions; the methods for preventing corrosion; and details of the arrangements for the compasses in iron ships.

13. On the changes that have been introduced, within the last fifteen years, in the lines of ships and steam vessels; and an examination of the effects produced by the new law of measurement for tonnage.

14. An examination of the circumstances which appear to limit the maintenance of higher speeds, than are now attained by steam ships in deep sea navigation; and an inquiry into the causes which have hitherto prevented the asserted high speeds of steam navigation on the American rivers, from being arrived at in England.

15. The best method of external condensation, so as to permit the employment of salt or of hard water, and furnishing pure water for the boiler; with a description of various systems of evaporating, refrigerating, &c.

16. The results of the use of tubular boilers, and of steam at an increased pressure, for marine and other engines, noticing particularly the difference in weight and speed, in proportion to the horse power and the tonnage; with details of the most successful means for avoiding smoke in furnaces of all descriptions.

17. The best methods of reducing the temperature of the engine and boiler room of steam vessels, and of preventing the danger arising from the overheating of the base of the funnel.

18. The relative efficiency of the screw propeller and paddle wheels, when applied to vessels of identical form, tonnage, and steam power, independent of the use of sails.

19. The results of the application of steam power and screw propellers to the conveyance of coal, as compared with the system of sailing vessels.

20. The arrangement and distribution of the workshops at the principal repairing station of a railway, for the repairs and maintenance of the locomotives, passenger, and other carriages, &c.

21. The construction of locomotive engines, specially adapted for steep inclines; with accounts of experiments, demonstrating the comparative value of large and small engines under various circumstances.

22. Improvements in the construction of railway carriages and waggons, with a view to the reduction of the gross weight of passenger trains. Also of railway wheels, axles, bearings, and breaks; treating particularly their ascertained duration and their relative friction.

23. The results of a series of observations on the flow of water from the ground in any large district, with accurately recorded rain-guage registries in the same locality, for a period of not less than twelve months.

24. The conveyance and distribution of water for the supply of towns; the sources from whence it may be derived, noticing the relative permeability of different rocks and soils, and their actual capacity for retaining and delivering water; a description of the different modes of collecting and filtering; and an account of the advantages or disadvantages of the high service constant supply system, with notices of the best forms of large valves, and of the best methods of jointing pipes of large diameter, to resist considerable pressure, and the precautions to be observed in laying the mains through mining districts, where the ground is liable to sink.

25. The comparative duty performed by the various descriptions of steam-engines for raising water for the supply of towns, or for the drainage of mines; noticing the depth and length of the underground workings, the height of the surface above the sea, the geological formation, the contiguity of streams, &c.

26. The drainage and sewerage of large towns, exemplified by accounts of the systems at present pursued, with regard to the level and position of the outfall, the form and dimensions of the sewers, the prevention of emanations from them, the disposal of the sewage, whether in a liquid or solid form, and of the arrangements for connecting the house drains with the public sewers.

27. On warming and ventilating buildings.

28. The precautions adopted for guarding against accidents by fire-damp in mines.

29. The results of contrivances for facilitating the driving of tunnels or drifts in rock.

30. Descriptions of the various kinds of machinery in use in the principal shipping ports, for the shipment of coal; noticing particularly those in which the greatest expedition is combined with the least amount of breakage of the coal; and also accounts of the means of unshipping, and measuring or weighing the coal in its arrival in port.

31. Descriptions of the ovens, and of the best processes used in Great Britain and on the continent, in the manufacture of coke for railway and other purposes; with the comparative values of the products.

32. Improvements in the system of lighting by gas; the results of the use of clay retorts, of large ovens (for producing a better quality of coke), of exhausters, condensers, and modes of purifying, and the precautions for the economical distribution of gas.

33. A mathematical or geometrical demonstration of the advantages of flat sails for ships, over those of different degrees of curvature, when exposed to direct and slanting winds; with practical examples.

34. On the application of machinery combined with mechanical power, and the means of transporting manure and produce on large farms and agricultural establishments; and on improvements in the plan of the works and buildings, and the 'plant' employed.

35. The most effective arrangement and form of centrifugal and reciprocating blowing apparatus.

36. The chemical analysis, and the application to economic purposes, of the gases generated in iron blast furnaces.

37. An investigation of the causes of "red" and of "cold-shortness" in malleable iron, and other chemical characteristics which affect the physical properties of cast or of wrought iron.

38. Description of cast or wrought iron cranes, scaffolding and machinery, employed in large works, in stone quarries, hoists or lifts on quays, in warehouses, &c., especially where either steam or water is used as a motive power.

39. The various systems of preserving timber from decay, and from the attacks of marine insects, or the white ant.

40. On the improvements which may be effected in the buildings, machinery, and apparatus for producing sugar from the cane, in the plantations and sugar-works of the British colonies, and the comparison with beet-root, with regard to quantity, quality, and economy of manufacture.

41. Description of the machinery adapted for the preparation of Indian cotton.

42. Improvements in flax machinery, and in the processes for preparing the flax for manipulation.

43. Notice of the principal self-acting tools employed in the manufacture of engines and machines; also of moulding machines and wood-working machines; and the effect of their introduction.

44. On the best system of remedying the inconvenience resulting from the present want of uniformity between the weights, measures, and coins of the different countries of Europe.

45. The construction of lighthouses; their machinery and lighting apparatus; with notices of the methods in use for distinguishing the different lights.

46. Memoirs and accounts of the works and inventions of any of the following engineers:—Sir Hugh Middleton, Arthur Woolf, Jonathan Hornblower, Richard Trevithick, William Murdoch (of Soho), and Alexander Nimmo.

Original papers, reports, or designs of these or other eminent individuals, are particularly valuable for the library of the Institution.

The communications must be forwarded, on or before the 30th of January, 1853, to the house of the Institution, No. 25 Great George Street, Westminster.

SOCIETY OF ARTS.

NINETY-NINTH SESSION, 1852-53.

The Council invite communications on the following, as well as other subjects, for premiums:—

CLASSES I. TO IV.—RAW MATERIALS.

1. For the best essay on salt; the sources from whence it is obtained, and the processes involved in its manufacture.

2. For the best essay on iron ore, and the manufacture of iron as carried on in different districts and countries; especially contrasting the iron manufacture of England with that of America and the continent of Europe.

3. For a cheap and efficient mode of extracting the metal from the iron sand (Teranaka) of New Zealand.

4. For the invention of any white metallic alloy, free from microscopic faults, which may be successfully applied to the arts, is hard enough for use in reflecting telescopes, and is not liable to be acted upon by the atmosphere.

5. For the discovery in England, or the importation from any of the British possessions, of plumbago, or of some other substance which may be used in lieu thereof, equal in quality to that now obtained from Cumberland.

6. For the discovery of a new fuel, which shall occupy less space, and be of less weight than any now in use, without diminution in the amount of heating power, or liability to injure metals in contact with it.

7. For an account of the processes involved in the preparation of charcoal, and its recent applications to manufacturing and other purposes.

8. For the best essay on the chemical composition of rocks—the changes which they have undergone, and are now undergoing; especially in relation to those which are used for building and other similar purposes.

9. For the best essay on the nature, composition, properties, geological distribution, and working of flag, slate, and other stones used for paving.

10. For the best essay on the nature and properties of granite; on the relative qualities of the material obtained from quarries in England, Scotland, Ireland, and the Channel Islands; and their comparative fitness for architectural and engineering purposes.

11. For an account of a new method of making sulphuric acid, which shall be equally efficient with that at present employed, and which shall not require the large leaden chambers now in use.

12. For an account of the manufacture of pure hydrochloric acid, free from all metallic impurities.

13. For the production of a bright blue colour, applicable to the manufacture of papier maché, and not liable to be affected by the atmosphere.

14. For an account of the manufacture of pure potash and soda, free from earthy impurities, as reagents for the use of chemists.

15. For an account of the economic manufacture of oxide of zinc, and its incorporation with other colours, so as to render them not liable to be acted upon by sulphurous gases, or to fade on exposure to the light and heat.

16. For the importation of not less than half a ton of well-dried plantains, or bananas, from the West Indies.

17. For the importation, from any British possession, of not less than one hundred pounds of dried fruits, of equal quality with those now imported from the Mediterranean.

18. For the importation of not less than one pipe of wine, of good marketable quality, made from the produce of vineyards in Australasia.

19. For the best essay on the theory and practice of fermentation, particularly as applied to the art of brewing; so as to modify, or altogether dispense with, the intermediate process of malting.

20. For an account of the processes employed in the manufacture of starch, the sources from whence it is obtained, and the purposes to which it is applied.

21. For a method of preparing an engine size for the use of papermakers, superior to any now in use.

22. For the importation of any new substance which can be successfully used as a substitute for caoutchouc.

23. For the importation from China, India, or elsewhere, of any new plants or trees producing oils or fatty substances, which can be used as food, or are applicable to manufacturing purposes.

24. For the importation of not less than ten gallons of olive oil, the produce of Australasia, or any other British possession.

25. For the production of oil and other substances from the cotton-seed, and the application of the refuse material to agricultural or manufacturing purposes.

26. For a method of refining vegetable oils by a quick and cheap process, so as to render them fit for burning in lamps, and for lubricating machinery.

27. For any new unguent suitable for lubricating machinery; with an account of the substances at present employed for that purpose, and from whence derived.

28. For improvements in the manipulation of bees-wax, so as to render it applicable to new purposes in art or manufacture.

29. For a cheap and efficient means of extracting dyes from dyewoods and other substances.

30. For the importation of not less than one ton of the root of the galium tinctorium from Canada.

31. For an account of improvements in dyeing turkey-red, by which the time required to produce a fast and brilliant colour may be reduced.

32. For the best samples of cotton from the South African Colonies.

33. For the best samples of cotton from the Western Coast of Africa.

34. For the most successful cultivation of flax in British India, or Australasia.

35. For an essay on the flax plants of India, the purposes to which they are at present applied, and the best means of employing the refuse material.

36. For the importation of at least two tons of any vegetable fibre, applicable to all the purposes for which hemp is now used, and equally cheap, strong, and durable.

37. For the best sample of any new ornamental wood, suitable for the manufacture of furniture.

38. For the introduction of a cheap and efficient substitute for alpaca wool.

39. For the importation from any British possession, of not less than one hundred pounds of silk, proper for manufactures.

40. For the importation from the East Indies, of silk equal in quality to the best Italian or China silk.

CLASSES V. TO X.—MACHINERY.

41. For an account of the most recent improvements in marine engines, having for their object the reduction of the weight, and the increase of speed.

42. For the best means of increasing the draught through the furnaces of marine boilers.

43. For the adaptation of a new submerged propelling power in marine navigation, which shall possess all the advantages of the screw-propeller, and be more immediately acted upon by the moving power.

44. For improvements in railway buffers, draw links, and means of coupling, especially applicable to merchandise and other waggons.

45. For an account of the mechanical means at present in use to facilitate the operation of packing goods, &c., whether by hydraulic presses, or otherwise.

46. For a resumé of recent improvements tending to shorten the processes and facilitate the production of different manufactures:—

1st. In reference to textile fabrics.
2d. In reference to fictile materials.
3d. New mechanical appliances.

47. For an account of recent American inventions, having for their object the substitution of mechanical processes for manual labour in the household and domestic arts.

48. For the most economic method of ginning cotton, so as to obtain the longest and cleanest fibre.

49. For improvements in machinery for printing calico and other fabrics, by which ten or more different colours may be worked simultaneously, and with accurate register.

50. For an account of recent improvements in machinery for breaking, cutting, and dressing flax.

51. For an account of improvements in machinery and processes for converting spun and other yarn into rope, twine, &c.

52. For an account of the methods now in use for working malleable iron; and of any recent improvements in the machinery employed for converting iron into bars, plates, &c.

53. For the construction of moulds without seams or joints for metal casting, in the round or in relief.

54. For the production of castings in iron, equal in sharpness and in delicacy of surface to those now imported from Berlin.

55. For a cheaper mode than any at present practised of working mouldings and other architectural features in granite, or other stones.

56. For the best, simplest, and most economic flour mill, for the use of emigrants and settlers.

57. For the best account of the methods at present employed in France and England for grinding, dressing, and otherwise preparing flour.

58. For improvements in the machinery and processes connected with the production of coffee—for treating the pulpy fruit, and for curing the beans.

59. For an account of recent improvements in the machinery and processes employed in the manufacture and preparation of sugar from the sugar-cane, and its comparison with beet-root sugar.

60. For the best account of recent improvements in the construction and laying out of large breweries, and the "plant" connected therewith.

61. For a simple and inexpensive apparatus for brewing beer, suitable for the use of cottagers or emigrants.

62. For the best essay on the means by which the roofs and walls of large buildings may be constructed so as to avoid interference, by echoes or sounds, with the utterance of a voice, and to render such audible to the largest number of persons; with especial reference to the building of lecture and meeting rooms.

63. For the best essay on the construction of fire-proof buildings.

64. For the best essay on the construction of common roads.

65. For an account, accompanied by a series of drawings, of the construction of saloon steamers on American rivers, and the adaptation of the principle to European river and ocean navigation.

66. For the most economic means of obtaining and maintaining a vacuum, and the purposes to which it may be applied.

67. For an essay on the scientific principles evolved in the application of the stereoscope.

68. For improvements in the oxyhydrogen microscope, and the method of illuminating it, by which a bright object may be presented on a dark ground.

69. For a cheap, convenient, and portable camera, with stand and materials complete, for taking calotype views.

70. For the most sensitive portable means of taking negatives for calotypes.

71. For the best means of bringing a distant object within range of a camera, when beyond its focus.

72. For an essay on recent discoveries in the production of photographic and talbotype images, especially in the taking of material objects by means of the microscope, with illustrations.

73. For a good and cheap method of making glass balance springs, suitable for marine chronometers.

CLASSES XI. TO XXIX.—MANUFACTURES.

Textile Fabrics.

74. For an account of the methods at present employed in the manufacture of paper, for the various purposes of art and commerce; especially such as may be used for printing, talbotype, and water-marking.

75. For a method of more thoroughly sizing machine-made papers with animal size.

76. For an essay on the application of indigo in the printing of calico, with special reference to new processes.

77. For improvements in surface-printing washing fabrics, by which body colours may be employed, without liability of removal by the action of fluids.

78. For an account of improvements in the methods of producing ornamental designs on silks, satins, and damasks; the designs to be of greater length, and obtained at less cost than by the jacquard loom.

79. For an improved method of bleaching linen safely and rapidly, and without the necessity of any after exposure "on the green."

80. For an account of recent improvements in the manufacture of carpeting by steam power, whether Brussels, velvet-pile, or terry; especially of processes by which the warp-threads are coloured to form the pattern before weaving. Also, for the application of new materials in the manufacture, uniting durability, economy, and elegance of design.

81. For improvements in the manufacture of embroidery by machinery, so that the production may more closely resemble that now made by hand.

82. For any improvement in the make, form, or material of hats.

Metallic, Vitreous, and Ceramic Manufactures.

83. For the invention of a good and cheap lock, combining strength and great security from fraudulent attempts; cheapness, freedom from disarrangement by dirt, and requiring only a small key.

84. For the best essay on ancient goldsmiths' work.

85. For an essay on the combination of engraving and chasing, in connection with electro-metallurgy, as applied to art-manufactures.

86. For any material improvement in the manufacture of crown glass, with special reference to transparency and durability of surface.

87. For the discovery of any mode for increasing the depth, brilliancy, and durability of the colours used in painting on glass, either by an improved process in vitrifying, or by any other means.

88. For the discovery of a cheap and effectual method of uniting pieces of coloured glass, so as to supersede the use of lead joints, or other unsightly modes of joining, in the construction of stained glass windows.

89. For a cheap and simple method of casting glass pipes for draining, and other similar purposes.

90. For the best account of the causes of the defects in flint glass, with the means which have been employed to remedy the same, accompanied by suggestions for the improvement of the manufacture.

91. For a method of producing large pieces of glass, free from veins, perfectly homogeneous, and suitable for optical purposes.

92. For an achromatic lens not less than three feet focus, capable of being used as quickly as smaller lenses, and suitable for photographic purposes.

93. For any important improvement in the construction of kilns for firing, or baking parian, china, and earthenware.

94. For an account of improvements in the material and processes for glazing earthenware and china.

Miscellaneous Manufactures.

95. For an essay on architectural and decorative ornaments; the materials employed, their mode of manufacture, and the comparative cost of production.

96. For an essay on the best examples of modern furniture in various materials, exhibiting sound principles of construction, in combination with decorative art.

97. For a means of "patching the sieve" used by block paper-stainers, without manual labour.

98. For an account of improvements in printing paper-hangings by machinery, by which solid ground or other colours may be laid, and the objections at present existing to the use of size may be overcome.

99. For the invention of an artificial stone, or terra cotta, free from the objections to which all such substances are now liable.

100. For an account of any material improvement in the moulding, burning, or general manufacture of bricks; the chief qualities required being strength, indestructibility, and cheapness.

101. For an account of improved modes of treating and applying gutta percha so as to render it less liable to be acted upon by changes of temperature.

102. For the best account of the most recent applications of new materials and processes in the manufacture of soap.

103. For the invention of a good and cheap candle for the use of miners; to have a high melting point, and not be liable to waste or gutter.

104. For the invention of a good and cheap bed-room candle, requiring no snuffing, and not liable to gutter or drip when carried about.

105. For the best account and collection of specimens of the various materials and processes employed in the production of artificial flowers.

CLASS XXX.—FINE ARTS.

106. For the best series of four outline drawings in illustration of the approach of night, as described in Petrarch's third ode.

107. For the best series of four botanical and structural drawings of a forest-tree.

108. For the best series of four botanical and structural drawings of one of the cerealia.

109. For the best series of four coloured botanical and structural drawings of any well-known English plant.

110. For the best series of four drawings of any animal, displaying its anatomy.

111. For the best series of four large drawings, or diagrams, suitable for lecturers, in illustration of any special branch of natural history, as the hemp or the flax plant, the silkworm, the cochineal insect, &c.; each drawing to be not less than three feet by four feet.

112. For the best series of four large drawings, or diagrams, suitable for lecturers, in illustration of any piece of machinery, as a loom, steam press, paper engine, &c.; each drawing to be not less than three feet by four feet.

SWINEY PRIZE.

In pursuance of the will of the late Dr. Swiney, a prize of £100 sterling, contained in a goblet of the same value, will be awarded by the council of the Society of Arts, to the author of the best published work on jurisprudence, which shall have appeared before January, 1854. Attention is particularly directed to that branch of jurisprudence which specially relates to art and manufactures.

SPECIAL PRIZE.

The Society's medal and a premium of £50 is offered for the best, and a premium of £25 for the second best essay on the history and management of literary, scientific, and mechanics' institutions; and especially how far, and in what manner, they may be developed and combined, so as to promote the moral well-being and industry of the country.

The Society of Arts will expect the authors to publish the selected essays under the sanction of the Society.

NOTICE.

The Society in all cases expressly reserves the power of rewarding each communication in proportion to its merit, or even of withholding the premium altogether. In every case, however, candidates may be assured that their claims will be judged with the utmost liberality.

All communications must be written on foolscap paper, on one side only, with an inch and a quarter margin. They should be accompanied by such drawings,

models, or specimens as may be necessary to illustrate the subject. The drawings should be to a sufficiently large scale, to be seen from a distance when suspended on the walls of the meeting-room.

In regard to colonial produce of all kinds, it is absolutely necessary that a certificate from the governor, or other qualified person, should accompany the samples sent to the Society, certifying that they really are the produce of the particular district referred to. The samples should be sufficient in quantity to enable experiments to be made, and an opinion to be formed of their quality. Cotton should be sent both in seed and picked. Flax should be accompanied by a description of the culture, the nature of the soil, the weight of the produce per acre, and the extent to which it is cultivated in the particular district. Silk, by a description of the method by which the silkworms were managed; of the kind of trees or plants on which they were fed, and particulars respecting the culture of such trees and plants. Wine, by an accurate description of the vineyards from whence produced. In every instance the maximum extent of the plantation from which the produce has been taken must be stated, with the average yield obtained, and whether similar articles have hitherto been exported from the colony, or not, and in what quantities.

All communications, and articles intended for competition, must be delivered to the Secretary, at the Society's house, free of expense, on or before the 31st of March, 1853. This restriction, as to the date of receipt, does not apply to articles of colonial produce. Any communication or paper read at any ordinary meeting, will be considered as the property of the Society, unless any previous arrangement has been made to the contrary. But should the council delay its publication beyond twelve months after the date of reading, the author will be permited to take a copy of the same, and to publish it in any way he thinks fit.

Successful candidates will be communicated with, on or before the 8th of June, 1853. Unrewarded communications and articles must be applied for at the close of the session, between the 8th of June and the 6th of July, 1853, after which date the Society will no longer be responsible for their return.

SOCIETY OF ARTS, EDWARD SOLLY, Sec.
John Street, Adelphi, London.

INSTITUTION OF MECHANICAL ENGINEERS.

OCTOBER 27, 1852.

After some general business remarks by the President, Mr. S. H. Blackwell of Dudley read a paper "On the Arrangement of the Materials in the Blast Furnace, and the application of the Waste Gases." This excellent paper was illustrated by examples and drawings from the Ebbw Vale, Cwm Celyn, Bilston new furnaces, Dundyvan, and Pontypool works. We shall draw upon it hereafter for some of the eminently practical information which it contains.

"On Improvements in the Construction and Materials of Railway Waggons," by Mr. W. A. Adams.

"On a new Self-Lubricating Axle-Box for Railway Engines and Carriages, and a Self-Acting Spring Crossing Point," by Mr. P. R. Hodge.

THE ROYAL SOCIETY.

NOVEMBER 30, 1852.

The anniversary meeting was held this day, the Earl of Rosse, President, in the chair. His Lordship delivered his annual address, passing under review the state and prospects of science.

The medals were then awarded as follows:—The Copley medal to Baron Humboldt, for his eminent services in Terrestrial Physics. This medal was received for the Baron by Chevalier Bunsen, who, in a long and eloquent address, returned the thanks of Baron Humboldt for the high honour paid him by the Society. The Rumford medal was awarded to Professor Stokes of Cambridge, for his very remarkable discovery of the "Change in the Refrangibility of Light." One of the Royal medals was awarded to Mr. Joule, for his paper on the "Mechanical Equivalent of Heat," printed in the *Transactions*; and the second Royal medal to Mr. Huxley, for his valuable papers on the "Anatomy and Affinities of the Family of the Medusæ."

The election of council and officers for the ensuing year was then proceeded with; after which the Society dined at the Freemasons' Tavern, the Earl of Rosse in the chair, supported by the Earl of Enniskillen, Sir R. Inglis, the Lord Chief Baron, Sir R. Murchison, Mr. Babbage, and others.

ROYAL SCOTTISH SOCIETY OF ARTS.

NOVEMBER 22, 1852.

The first meeting of the 32d session was opened by a general address from Dr. Lees, the retiring President.

The following report of the prize committee, awarding the prizes for session 1851-52, was then read, and the prizes were delivered by the President to the successful candidates, viz.:—

"Your committee having met and carefully considered the various communications laid before the Society during session 1851-52, beg leave to report that they have awarded the following prizes:—

"To Mr. John Sang, land-surveyor, Kirkaldy—for his 'Description and Drawings of a Platometer; an instrument for measuring the area of figures drawn on paper.' Read, and the instrument in various forms exhibited, 12th January, 1852.—The Keith medal and plate, value thirty sovereigns.

"*Note.*—Your committee have with great care investigated Mr. Sang's claim to originality, and are perfectly satisfied on that head, although they are aware that instruments somewhat analogous in construction have been employed on the continent. Your committee have also taken pains to collect the opinions of some of those gentlemen who have had an opportunity of comparing Mr. Sang's instrument with others, and their opinions coincide with those of your committee.

"2. To Mr. John Adie, F.R.S.E., optician, Edinburgh—for his 'Description of an Instrument by which the Variation of the Magnetic Needle can be determined with a greater degree of accuracy than his been attainable in Field Surveying.' Read, and the instrument exhibited, 26th April, 1852.—The Society's silver medal and plate, value ten sovereigns.

"3. To Mr. John Howell, polyartist, Edinburgh—for his 'Description of an Improved Jointed Artificial Leg for short Stumps of the Thigh.' Read, and a working model exhibited, 8th December, 1851.—The Society's silver medal, value three sovereigns.

"4. To Mr. William M'Craw, 287 High Street, Edinburgh—for his 'Description of a Portable Apparatus for taking, developing, and fixing Glass Photographic Pictures in the Light, without any Dark Apartment.' Read, and the apparatus, and specimens of pictures taken by it, exhibited, 12th April, 1852.—The Society's silver medal, value three sovereigns.

"5. To Mr. Louis Niman, journeyman bootmaker, St. Vincent Street, Edinburgh—for his 'Description and Drawings of a Bootmaker's Plane.' Read, and the plane exhibited, 8th March, 1852.—The Society's silver medal, value three sovereigns.

"6. To Daniel Wilson, LL.D., Sec. Antiq. Soc. of Scotland—for his 'Paper on some New Methods calculated to facilitate the application of Ancient Arts to the Decoration of Sepulchral Monuments.' Read, and various illustrations exhibited, 12th January, 1852.—The Society's silver medal.

"7. To Mr. Thomas E. Mortimer, gunmaker, Edinburgh—for his 'Description and Drawing of a Bullet-Mould for Minie Rifle Balls.' Read, and the bullet-mould exhibited, 12th April, 1852.—The Society's silver medal.

"8. To Mr. John Goodfellow, Buccleuch Street, Hawick—for his 'Description and Drawing of Public Baths and Wash-houses established at Hawick.' Read 8th December, 1851.—The Society's silver medal.

"9. To Mr. William Hart, gardener, late near Jedburgh, now in Australia—for 'the Ingenuity displayed by him in the construction, under many disadvantages, of a Galvanic Apparatus for Medical purposes,' which was exhibited in action, and the description read, on 12th January, 1852.—Two sovereigns.

"The committee recommend, that while the thanks of the Society are justly due to all those gentlemen who have sent communications, the special thanks of the Society be given to the following gentlemen, viz.:—

"1. To Edward Sang, Esq., professor of mechanical philosophy at the Imperial School, Muhendis-hana Merii, at Constantinople—for his 'Account of Observations on the Solar Eclipse of 28th July, 1851, made at Sebastople.' Read 24th November, 1851; and printed in the Transactions.

"2. To Professor C. Piazzi Smyth, F.R.S.E., astronomer-royal for Scotland—for his 'Oral Exposition of a Method of Raising Water by means of Wind, employed by him at the Cape of Good Hope.' Exposition given 10th November, 1851.

"3. To Robert Wm. Kennard, Esq., 67 Upper Thames Street, London—for his 'Communication on the Substitution of Cast-Iron for Wooden Sleepers.' Read, and illustrative drawings exhibited, 30th June, 1851.

"4. To James Leslie, Esq., civil engineer, Edinburgh—for his 'Account of the Bursting of Bilberry Reservoir.' Illustrated with drawings. Read and exhibited, 26th April, 1852.

"5. To J. Lawrenson Kerr, Esq., civil engineer, Edinburgh—for his 'Description of a Cast-Iron Swing Bridge, constructed for Peterhead Harbour by Messrs. Blackie, Panmure Foundry, from Designs by Messrs. Stevenson, civil engineers.' Read, and drawings exhibited, 9th February, 1852.

"6. To Mr. George H. Slight, engineer, Edinburgh—for his 'Description and Drawing of an improved Instrument for Drawing Eclipses.' Read and exhibited, 23d February, 1852.

"7. To William Campbell, Esq., civil engineer, Edinburgh—for his 'Notice of the recently-discovered Iron District of Cleveland, Yorkshire; with Specimens of the large masses of Ironstone now being quarried at Easton-Nab there.' Read and exhibited, 22d March, 1852.

"8. To Messrs. John Dickson & Son, gunmakers, Edinburgh—for their 'Account of Experiments made on the Minie Rifle at Dalmahoy Moss, with Remarks on its use as proposed in the Army.' Communicated, along with some general views of the principles of this branch of gunnery, by George Buchanan, Esq., C.E., F.R.S.E. Read, and rifles and balls of different forms, with bullet-moulds, exhibited, 22d March, 1852.

"9. To Mr. William Grosart, Grangemouth, by Falkirk—for his 'Memoranda in regard to the History of Steam as a power for Propelling Ships, &c.; and, in particular, as to the late Mr. William Symington's connection with that subject.' Read, and the original pattern of the shaft of the 'Charlotte Dundas' exhibited by Dr. Wilson, Sec. Antiq. Soc. of Scotland, 23d February, 1852.

"Your committee must add, that the Society were much indebted to their former esteemed President, the late Thomas Grainger, Esq., F.R.S.E., for his Account—in continuation of those formerly read before the Society—of the progress made in the Drainage of Haarlem Meer during the last year; and that it is their duty to record in this report his energy and zeal in personally obtaining on the spot the necessary information, to enable him to present this interesting subject to the Society from the most authentic sources.

"The committee have farther granted, for the purchase of a model, illustrative of a paper read during the session, the sum of three pounds.

"All which is humbly reported by
"JAMES TOD, Sec.,
"Convener, *ex officio*."

MONTHLY NOTES.

DISCOVERY OF THE METALLIC BASE OF PHOSPHORUS, BY MR. R. SMITH. —When glacial phosphoric acid, or oxide of phosphorus, is ignited in contact with potassium, in a glass tube, we obtain a greenish-black substance, of a brittle nature, and possessing a slightly metallic lustre, and much heavier than either water or phosphorus. When exposed to atmospheric influences it attracts oxygen, and is soon covered with a crust of oxide of phosphorus. Thrown into water, it decomposes that liquid, and hydrogen is liberated—the oxygen combining with it, and forming oxide of phosphorus, which remains at the bottom of the vessel undissolved. If a portion of this substance is brought into contact with mercury, amalgamation takes place; and an amalgam is also effected when mercury is heated along with it in a glass tube, the union being accompanied with a slight explosion. When a portion of the amalgam is placed in water, it is decomposed; the mercury is separated, and the metallic substance combines with the oxygen of the water, forming oxide of phosphorus. A portion, heated nearly to redness in the open air, inflames, and phosphoric acid results. It is, then, clear from these experiments, that it possesses at least as strong a claim to the rank of a metal as boron, silicon, or ammonium; and, consequently, upon the same principle of relation, it follows that it is entitled to the appellation of *phosphorum;* and further, that the interesting substance which we know by the name of phosphorus, is phosphorum charged with electricity and light. The discoveries of electro-magnetism and magneto-electricity prove, that electricity and magnetism are essentially identical, but operating under distinct and various forms; and the same holds good with regard to the beautiful relations which Dr. Faraday has shown to exist between magnetism and light. Electricity may, indeed, be considered as the first-born element of chaos, and light as one of its modifications, existing as an independent essence, universally diffused throughout the universe, and capable of being set free from its latent state by various natural and artificial operations. Phosphorescent light is distributed throughout all kinds of matter. It is seen in putrefied flesh, insects, decayed vegetables, the waves of the sea, and in many varieties of minerals. It is also communicated to mineral substances by means of electricity, light, and heat. But of all the preparations at our command, phosphorus stands the most prominently forward. Phosphorus is an exceedingly curious substance, of a white, waxy consistence, and holding in combination a live fire, or phosphorescent light. As in the case of a number of the metals, it combines with oxygen, forming acids, and a red oxide, mentioned in our notes on obtaining phosphorum. It has a powerful affinity for metals—precipitating them from their solutions—in a metallic state. It also forms what are called phosphurets, but which might more properly be termed alloys. But the alloy of phosphorus and potassium, long known as phosphuret of potassium, must not be confounded with this new substance—the properties of the two being quite distinct. Phosphuret of potassium burns with great brilliancy when heated in the open air; and when thrown upon water, explosion and combustion occur, in consequence of the disengagement of phosphuretted hydrogen. Phosphorum inflames when heated in the air, but not with the intensity or brilliancy of phosphuret of potassium. Water is decomposed by it with rapidity, but without explosion or combustion, or the production of phosphuretted hydrogen, the pure hydrogen of the water only being liberated.

PRIZE FOR THE IMPROVEMENT OF ARTIFICIAL MANURES.—In the course of the recent discussion on the Lobos Islands question, Mr. Fisher Hobbs, and some of the other active members of the Royal Agricultural Society, ventured a proposition for the offering of a prize in connection with an attempt to substitute an artificial manure for the costly production of Peru. This has now taken an actual bodily form; and at the last Monthly Council of the Society, with Lord Ashburton in the chair, the following report was agreed on:—

"I. *Terms of the Prize.*—A thousand pounds and the gold medal of the Society will be given for the discovery of a manure equal in fertilizing properties to the Peruvian guano, and of which an unlimited supply can be furnished to the English farmer at a rate not exceeding £5 per ton.

"II. *Conditions of Competition*, agreed to by the committee, at a meeting held on the 10th of November, 1852:—

"1. That in the offer of £1000 and the gold medal of the Society, as a prize for the discovery of a manure equal in every respect in its fertilizing properties to Peruvian guano, the £1000 shall be offered in one undivided sum.

"2. That the standard of such Peruvian guano shall be assumed to be the average result obtained by Professor Way, the consulting chemist to the Society, and published in his paper in the 10th volume of the *Journal*, pages 205—208.

"3. That each competitor claiming the prize shall send in with his sample a chemical analysis under seal, together with such practical proofs of the successful application of the manure to growing crops of grain, roots, and grasses, as he can produce, duly certified by growers. That such samples of manure shall be liable to be subjected to all such further tests, and for such period of trial, as the Council may deem requisite.

"N.B.—All claimants shall, on application made to them by the Secretary, be expected to supply, free of expense to the Society, such quantity of their respective manures as may be required for trial.

"4. That no claim for the prize will be entertained unless the claimant can satisfy the Council that an unlimited supply of the manure, at a price not exceeding £5 per ton, will at all times be within the reach of the agriculturists of the United Kingdom.

"JOHN VILLIERS SHELLEY, Chairman."

CITY IMPROVEMENTS—LONDON AND PARIS.—An important scheme is now in progress for the construction of a railway, with a footpath alongside of it, from London Bridge to Westminster Bridge. The line is to be carried along a viaduct composed of a series of iron girders, supported by cast-iron piles driven into the bed of the river at a certain distance from the north bank of the Thames, so as not, in the opinion of the promoters, to interfere with the navigation or traffic of the river, being erected a certain height above high-water mark. It is proposed to have stations at the Old Swan Wharf, near London Bridge; at Southwark Bridge, St. Paul's Wharf, City Pier, Blackfriars Bridge; Eagle Wharf, Essex Street; Waterloo Bridge, Hungerford Pier, and at Westminster Bridge. Such a thoroughfare, if it is really practicable, without inordinate expense, or in convenience with the present water-side arrangements, must be of vast benefit to the metropolis. From Paris, also, we learn that the Municipal Commission has decided on continuing the splendid arcades of the Rue de Rivoli as far as the Rue des Poulies. The *enquête* which had been ordered to deliberate on the continuation of the arcades from the corner of the Rue des Poulies as far as the Quai de l'Ecole—that is to say, for all the ground which fronts the colonnade of the Louvre—has not yet come to a decision; but M. Duban has drawn up a plan for some houses, which will harmonise better with the architecture of that building than the arcades. This plan, which is now under the consideration of the Government, will also include the regularization of the Place St. Germain l'Auxerrois, and the isolation of the church on the side of the Rue Chilperic and the Rue des Prêtres. However this may be, it is now certain that the arcades of the Rue de Rivoli shall be prolonged as far as the corner of the Rue des Poulies, with a return on the Place du Palais Royal, and that, in the remainder of the new street, the proprietors shall enjoy full liberty in their construction. Various other minor improvements have also been recently sanctioned by the French people, in a spirit which shows their determination that Paris, at least, shall go on increasing in grandeur and stately magnificence.

PURIFICATION OF ILLUMINATING GAS.—Since our incidental remarks of last month, on the question of the intimate concern of the points of impurity and objectionable heat, with the more general introduction of gas for domestic lighting, we find that a new mode of purifying treatment has been partially developed. In this process, which promises to improve the quality of the gas to a very considerable extent, lime is entirely dispensed with, acidulated peat charcoal being substituted. This application effectually carries off the sulphur and ammonia, the presence of which is highly objectionable, both as regards injury to the lungs of those who breathe an atmosphere laden with such matters, and the destruction of the colours and brilliancy of effect in textile goods, gilding, and the great variety of ornamental works which are involved in house-decoration. The inventor also claims an additional value of 10 per cent. of illuminating power in gas so treated, whilst the spent purifying matters are capable of conversion into a commercially valuable manure.

INDIA-RUBBER FITTINGS FOR WINDOWS.—An application of india-rubber, which most people, who have at all considered the uses of this admirable material, must have often contemplated, has at length been really introduced in America. It is as a substitute for the common putty attachment of panes of glass in windows. The fixed frame has, first of all, a strip of the elastic material laid upon it, along all four sides where the glass sheet is to bear. The glass is then deposited, *in situ*, upon this as a fitting substratum, and it is held down by a light external frame-piece of wood. A few screws bind this outside piece down, and compress the glass upon its elastic bed. Such a mode of fitting ought to supersede the present ill-adapted system at once.

NOTES ON DRAUGHT.—Nowhere, perhaps, in the world—at least in any proportionably civilized country—is animal power so sadly misapplied and wasted as in London, and some of our southern agricultural counties. In London we see every day strings of four, five, and six of the magnificent dray-horses—so often and so proudly spoken of as the most splendid specimens of the genus *equus* which are anywhere to be met with—yoked, tandem-wise, to a single waggon, of proportions by no means gigantic. Now, can it really be necessary for us to tell the prodigal employers of this class of animal power, that such a system is an extravagant absurdity? We could find to-morrow, in Thames Street, at least a dozen elephant-like horses, each of which is equal in point of tractive power to three ordinary horses, such as we find yoked in single-horse carts in other parts of the kingdom; and yet nothing is more common than to find a chain of such animals drawing a load quite disproportionate to their combined power, and this only in one direction of their travel. We know that a good horse, of only light build, will take 30 cwt., or two tons, in a single light cart, with ease. He is near his load, and pulls with the well-applied exertion of his undivided frame. But with a *string* of horses, it is physically impossible to combine their power with anything at all approximating to a proportionately useful effect. Each animal tugs for itself. One pulls high, another pulls low; a third pulls out of the straight line. They cannot all pull together. If four horses *are* required—and we think they ought not to be necessary in the streets of the metropolis—by all means let them be yoked two abreast. In this respect a lesson may be taken from the Glasgow omnibuses, where a lengthened experience has shown, that three horses in regular work, yoked abreast, give as much real effect as four in the ordinary way. A very common objection to this arrangement is, that the narrowness of the business streets of London—even Fleet Street and Cheapside—prevents the free transit of such vehicles. This may be true to some extent, but it is no argument against the use of dray-horses, yoked two abreast, in heavy waggons, in the way we propose. Again, as regards ploughing, the same thing occurs; and we find four horses yoked at length, to do precisely the same work that is accomplished, in the north of England and Scotland, with two horses only, a single man managing the whole affair. Whilst we are on the subject of draught, we may find time to condemn a barbarous custom, which is, perhaps, nowhere more prevalent than in Glasgow. This is the system of locking the wheels of heavy timber waggons in descending hills. The driver invariably locks the front wheel next the horse, and the result is just what every one has felt who has drawn a garden-roller, whilst a stick has been stuck through the spokes above the tractive lever. Not only is the back of the shaft-horse excessively pressed down by the tension of the locking-rope on the shaft, caused by the attempted revolution of the wheel; but a constant and intensely annoying vibratory action is communicated to the entire frame of the horse by the jar of the locked wheel. Both these evils would be avoided by the simple expedient of locking the hind-wheel.

CROCHET WORK, AN INDUSTRIAL RESOURCE.—We daresay "practical mechanics" know very little of "crochet." It does not fall quite within their routine of subjects, and yet they will perhaps permit us to steal a small space for this little matter, in order that we may draw attention to a most praiseworthy project, involving an important outlet for painstaking industry. In 1847, the late Lady Deane, strongly compassionating the sore distress of the poorer classes in her district, established an industrial occupation for young girls and adult females, at Black Rock, Cork, by initiating them into the mysteries of the art and practice of *crochet*. The indefatigable exertions of the humane founder have met their reward. In the first year, the sale of the handiwork of her pupils produced £200; since that time, the large sum of from £1,000 to £1,200 per annum has been realized—the lowest weekly earnings of the individual producers being 2s., whilst the highest reaches 15s. By the kindness of Mr. C. B. Newenham, of Dundanion Castle, Cork, we have been put in possession of specimens of the actual productions of this now widely-extended class of industrialists, and these examples have been pronounced, by competent judges, to be of unequalled beauty and cheapness. We can but add, that we shall have the greatest pleasure in doing anything to aid in the extension of so laudable a movement, and, in particular, in opening up fresh outlets for the disposal of this branch of Irish industrial produce.

EVERETT'S PROTEAN PUZZLE.—Messrs. Simpkin and Marshall have just published an ingenious trifle, invented by Mr. J. D. Everett of Totteridge, and named by him the "Protean Puzzle." It consists of seven distinct slips of wood of the ordinary puzzle fashion—a square; two right-angled triangles, having the perpendicular equal to half the length of the base, or to a side of the square; and four sections of triangles of similar proportions, the section in each case being by a perpendicular through the middle of the base. This is truly enough a "Protean puzzle," for the accompanying book of instruction shows no fewer than 200 transmutations formed with the whole seven pieces. The inventor confesses that its primary purpose is mere amusement, but strengthens his position by showing how the collection may be adopted for the illustration of theorems in geometry and mensuration, whilst he gives an example of its application to a problem from Euclid.

THE SMITHFIELD SHOW OF AGRICULTURAL MECHANISM.—The machinery of agriculture receives but slow development in this manufacturing country. Our spinners and weavers, our engineers and shipbuilders, and most of the other scattered members of the arts of construction and conversion, are always intent upon whatever promises to facilitate their operations, and cheapen their productive costs. But the agricultural mind is proverbially slower in the acceptation of novelties, and less inclined to risk even trifling matters for the favourable chance of larger gains. Still, each succeeding gathering in Baker Street tells us of some advancing steps, and gives us assurance that mechanical excellence is progressing in the fields—sluggishly, it is true; yet "as plants convert the minerals into food for animals, so each man converts some raw material in nature to human use," and gives some help to onward progress. Amongst such a mass of articles, totally uncatalogued and unclassified, particularization is a haphazard matter; so that we can only note a few of the more prominent machines, which at once invite inspection, and tell their own story. In ploughs, the "Companion subsoil," by Mr. Gillett, of Brailes, is important, from its effecting two operations at once. In addition to ploughing, a forward share, fastened to the beam, follows in the horses' track and subsoils, breaking up the earth, in readiness to receive that thrown over upon it by the turn-furrow. The "Northumberland clod-crusher," by Messrs. Gibson, of Newcastle, has been several times favourably and substantially noticed for its simplicity and efficient action. The "Expanding harrow," by Mr. Coleman, of Chelmsford, affords the power of harrowing, either wide or narrow, coarse or fine. It is made on the parallel-ruler principle, so that the intervals of the lines are always retained at a uniform set, whilst all the adjustment for any variation is that of altering the position of the hooks in two chains. Messrs. Garrett exhibit the broad-cast "Manure distributor" of Mr. Blyth, of Burnham, remarkable for its facile delivery of intractable top-dressing manures, such as guano and nitrate of soda. The manure is delivered to a barrel, in which a pronged shaft revolves, the teeth being brought into contact with a set of scrapers, which rise with and clean the revolving barrel, without the aid of brushes. The manure then passes to a shoot, in which alternated lines of wire are placed, for a yet further disintegration of the mass. Of reapers, there is a large collection. Messrs. Dray and Garrett show the American rivals, and Messrs. Crosskill, who have become the makers of the Rev. Patrick Bell's machine of 1829, have a capital example of that ingenious invention. Instead of beveling the cutters on both sides, as in the first American machines, Messrs. Garrett now make Hussey's reaper with a scissors blade, the single bevel working against a fixed square edge of steel. This is a great improvement, giving a steady, keen cut. Two horses, a man and a boy, cut about an acre an hour with it. Mr. Stacey, of Uxbridge, has a "British reaping and mowing machine," which, in cutting corn, receives it on a self acting carrier, and a cradle at the side divides it, and lays it on the ground, out of the returning horse-track. By removing this receiving and delivering apparatus, green crops may be cut. Mr. Williams, of Bedford, has a "Patent horse-rake," a useful implement, in which the teeth are adjustable in iron sockets, to be removable at pleasure; and as the teeth act on a bar, set parallel below the frame, facility is afforded for disengaging the accumulations. A "Hand-mill," by Messrs. Lloyd & Sons, which grinds and dresses at once, the ground matters being delivered from the inclined dressing-cylinder, by revolving brushes, into distinct compartments, very minutely divided for fine flour, firsts, seconds, pollard, and bran. Mr. Gillett has also a "Universal grain-mill," for splitting beans, kibbling oats, or grinding barley, very ingeniously arranged, with separate compartments of the hoppers, to perform the intended variety of work without the necessity of separate adjustment. The "Chaff-cutters" of Messrs. Richmond, of Salford, also sustain the high character of that firm for this class of work. They have materially improved the form of the roller-teeth, and have added a simple and manageable knife-sharpener. Messrs. Wedlake have also a combined "Straw-cutter and oat-bruiser," capable of performing these distinct operations together or separately, at the rate of 10 or 15 bushels of cut-straw, and two or three bushels of oats, per hour. Messrs. Cottam & Hallen's "Draining-level" is a cheap and good apparatus, suitable for the farm labourer. This firm also shows an "Odometer," or distance-measurer, which indicates 20,000 yards with one setting, and tells off the distance to feet. Messrs. Clayton and Shuttleworth, of Lincoln, have a good collection of agricultural steam-engines. So also have Messrs. Tuxford, of the Boston and Skirbeck Iron Works; and Messrs. Holmes, of Norwich, also show, besides, a large machine, which thrashes, shakes, riddles, and winnows. Messrs. James, of Leadenhall Street, have some capital weighing machines, and other apparatus of a miscellaneous class; and Messrs. Burgess & Key show Unuru's lift and force pump, an apparatus well adapted for the rough and various work of the farm. A set of liquid manure and other pumps, and hydraulic rams, is also exhibited by Mr. Freeman Roe, of the Strand, a gentleman whose name is most creditably associated with this special manufacture. Mr. Williams has also a good "Drain tile and pipe machine," workable by a single man, and fitted with a clay-box, having a content of 1450 cubic inches.—Such is a rough detail of the collection, which, in the midst of its many improvements, speaks of work to be done in the removal of superfluous weight and complication of parts, and contrasts the advance of chemical and theoretical science with the backwardness of mechanical construction. But it is some satisfaction to know, that the mechanism of the fields is in an actively progressive stage. "The destiny of organized nature is amelioration, and who can tell its limits? It is for man to tame the chaos; on every side, whilst he lives, to scatter the seeds of science and of song, that climate, corn, animals, men, may be milder, and the germs of love and benefit may be multiplied."

PROVISIONAL PROTECTIONS FOR INVENTIONS

UNDER THE PATENT LAW AMENDMENT ACT.

☞ When the city or town is not mentioned, London is to be understood.

Recorded October 30, 1852.

571. Thomas S. Bale and Frederick G. Sanders, Stafford—Improvements in machinery or apparatus for grinding and mixing clays, or other plastic materials.
572. Henry Brinsmead, St. Giles-in-the-Wood, Devonshire—Invention for shaking straw, to be attached to thrashing-machines.
585. John Whitcomb and Richard Smith, Kidderminster—Improvements in the manufacture of carpets, hearth-rugs, and other similar fabrics.
587. James Rock, yr., Hastings—Improvements in railway carriages.
684. Thomas Dunn, Pendleton, and William Watts, jun., Miles Platting, near Manchester—Improvements in the construction of railways.

Recorded November 10.

700. William Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in machinery or apparatus for sewing.—(Communication from abroad.)
702. Joseph T. Powell, 28 Fenchurch-street—Improvements in mixing, baking, and drying materials in the making of biscuits, and other articles where plastic matters are employed.
704. Louis G. Guerin, Paris—Improvements in fire-places.

Recorded November 11.

705. Robert H. Nicholls, Bedford—Invention of stopping railway carriages.
706. Ernst Luedeke, Bedford-street, Strand—Improvements in obtaining and applying motive power.
709. George Lucas, Manchester—Composition for filling engraved cast or sunk letters, devices, or ornaments, on or in brass, zinc, or other metallic plates.
710. James Noble, Leeds—Improvements in combing wool and other fibres.
711. Colin Mather and William W. Platt, Salford—Improvements in machinery for finishing linen, cotton, and other fabrics.
712. Christian Sharps, Hartford, Connecticut, U.S.—Improvements in breech-loading fire-arms.
713. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in machinery or apparatus for sewing and stitching.—(Communication from abroad.)
714. Henry Huart, Cambrai, France—Improvements in the storing and preservation of grain.
715. James C. Wyper, Glasgow—Improvements in the figuring and ornamentation of bookbindings, and covers of a similar character.
717. William Davis, Leeds—Improvements in machinery for cutting files.

Recorded November 12.

718. William E. Middleton, Birmingham—Invention of a new or improved circular saw-bench.
719. Sir Charles Fox, Knight, New-street, Spring-gardens—Improvements in roads.—(Communication.)
720. Henry Fletcher, Manchester—Improvements in the application of electro-magnetism for the production of motive power.
721. Caleb Bloomer, West Bromwich—Improvements in the manufacture of anchors.
722. George Kendall, Providence, U.S.—Improvements in apparatus to facilitate the manufacturing of mould candles.
723. Daniel Henwood, Chalten-street, Somers Town—Improvements in machinery for registering the number of passengers or persons entering public vehicles or vessels, theatres, bridges, or other places where it may be desirable to ascertain the number of persons entering therein.
724. Charles Seaton, Fitzroy-street—Improvements in the manufacture of metal tubes, and in the machinery employed therein.
725. Julien F. Belleville, Paris—Improvements in generating steam for producing motive power or heat.
726. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in reaping machines, and in apparatus connected therewith.—(Communication from abroad.)
727. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in measuring and registering the flow of fluids.—(Communication from abroad.)
728. George Stenson, Northampton—Improvements in apparatus for separating gold from auriferous sand and earth.
729. Thomas Day, Hammersmith—Improvements in landing and screening coals, and delivering them into sacks.

Recorded November 13.

730. George Philcox, 3 Winchester-buildings—Improvements in marine chronometers and other time-keepers.
731. Edward Davy, Crediton—Improvements in the preparation of flax and hemp.

733. John Caborn, Denton, Lincoln—Improvements in corn-thrashing and dressing machines.
734. Professor Andrew Crestadoro, of Genoa, Darlington-place, Vauxhall—Improvements in rapid communications between distant places and countries.
735. Robert Lucas, 3 Furnival's-inn—Improved machinery to be used in the preparation of cotton and other fibrous materials for spinning.—(Communication from abroad.)
736. Somerville Dear, Leeds—Improvements in the arrangement and apparatus of looms for weaving centre or other large patterns or designs in linen, cotton, silk, wool, or other fibrous materials.
737. John Paterson, Wood-street—Improvements in apparatus for shaping collars and other similar linen and cotton articles.
738. Richard Coad, London, and John P. Coad, Liverpool—Improvements in fire-places, and means of applying heat.
739. Amory Hawkesworth, Torquay—Improvements in life-boats.
740. Admiral the Earl of Dundonald, Belgrave-road—Improvements in apparatus for laying telegraphic or galvanic wires in the earth.
741. Samuel Sedgwick, Piccadilly—Improvements in lamps.
742. Hugh Greaves, Salford—Improvements in the permanent way of railways.
743. Peter Forbes, Shettleston, Lanarkshire—Improvements in sowing or depositing seeds in the earth.

Recorded November 15.

744. Gray D. Edmeston, Salford, and Thomas Edmeston, Pilkington—Improvements in steam-engines, which improvements are also applicable to the regulating of water-wheels or similar machinery.
745. James Hogg, jun., Edinburgh—Improvements in machinery for producing glazed or smoothed surfaces on paper and other vegetable fabrics.
746. Joseph Cowen and Thomas Richardson, Newcastle-upon-Tyne—Improvements in the manufacture of sulphuric acid.
747. Robert Reyburn, Greenock—Improvements in the composition of lozenges and other confections.
748. Constant J. Dumery, Paris—Improvements in the manufacture of metallic pipes and tubes, and in the machinery employed therein.
749. Auguste E. L. Bellford, 16 Castle-street, Holborn—Improvements in apparatus for inhaling iodine.—(Communication from abroad.)
750. John Mirand, Paris, and 16 Castle-street, Holborn—Improvements in the construction of electric apparatus for transmitting intelligence.
751. Peter Armand Lecomte de Fontainemoreau, 4 South-street, Finsbury—Improvements in lamps.—(Communication from abroad.)
752. George Berry, Buttersland-street, Shoreditch—Improved method of roasting coffee.
753. Robert Sandiford, Tottington Lower End, near Bury—Improvements in apparatus for block-printing.
754. William F. Rae, Edinburgh—Improvements in gas-heating and cooking apparatus.
755. James Robertson, Glasgow—Improvements in the manufacture of casks and other wooden vessels.
756. Francis M. Jennings, Cork—Improvements in preparing flax, hemp, China-grass, and other vegetable fibrous substances.
757. Thomas Taylor, Manchester—Improvements in apparatus for measuring water and other fluids, which apparatus is also applicable to the purpose of obtaining motive power.
758. William E. Newton, 66 Chancery-lane—Improvements in knitting machinery.—(Communication from abroad.)
759. Abraham Rogers, Bradford—Improvements in apparatus used for forming sewers, tunnels, and ways.
760. John D. Goodman, Birmingham—Improvements in boxes and axles for carriages.—(Communication from abroad.)
761. Samuel Holt, Stockport—Improvements in weaving cut piled fabrics.
762. Joseph Burley, Halifax—Improvements in apparatus for cutting fustians and other fabrics, to obtain a cut pile surface.

Recorded November 16.

763. Joseph S. Edwards, Blackfriars-road—Invention of a self-acting pea-kiln, or apparatus for moving grain, pulse, seeds, malt, or other similar substances while drying, which insures a more rapid desiccation, and requires scarcely any of the manual labour now employed in kilns, to be propelled by steam, water, or horse power.
764. Thomas Chrippes, yr., Petworth, Sussex—Improvements in the means of tilling land.
765. Joseph Johnson, Dublin—Improved mode of producing ornamental articles, such as brooches, bracelets, dressing and other cases, work and other boxes, or other like articles, from a certain kind of wood.
766. William Marsden, Blackburn—Improvements in and applicable to looms for weaving.
767. John Ramsbottom, Manchester—Improvements in steam-engines.
768. John W. Lea, Worcester, and William Hunt, Stoke-Prior—Improvements in utilizing the waste heat of coke furnaces.
769. François Vallée, Bruxelles, Belgium—Improvements in preparing, spinning, and doubling flax, cotton, wool, silk, and other fibrous materials.
770. John O'Keefe, Liverpool—Invention of a method for making watchcases by machinery.

Recorded November 17.

771. John T. Way, Holles-street, and John M. Paine, Farnham—Improvements in the manufacture of burned and fired ware.
772. Isaac L. Bell, Newcastle-upon-Tyne—Improvements in the treatment of certain compounds of iron and sulphur.
773. Henry Russell, Norwich—Improvements in pianofortes.
774. John Hinchcliff and Ralph Salt, Leeds—Improvements in steam-engines.
775. Peter Armand Lecomte de Fontainemoreau, 4 South-street, Finsbury—Improvements in weaving elastic tissues.—(Communication from abroad.)
776. Francis Bresson, Paris—Invention of a new and improved mode of propelling on land and water.
777. William Watt, Glasgow—Improvements in preparing for weaving, and in weaving flax and other textile materials.
778. Henry V. Physick, Aberdeen-place—Improvements in electric telegraphic apparatus, and in machinery or apparatus for constructing the same.

Recorded November 19.

779. James Rock, yr., Hastings—Improvements in buffers.
780. James Potter, Manchester—Improvements in machinery for spinning cotton and other fibrous substances.
781. James Hume, Birkenhead—Improvements in water-closets.
782. John V. Vernon and John Edge, Manchester—Improvements in apparatus and machinery for engraving rollers of glass, copper, brass, and other metallic compounds.
783. George Hamilton, Paisley—Improvements in spreading or distributing starch, gum, and other semi-fluid matters.
784. Robert Walker, Glasgow—Improvements in the construction of portable houses and other erections.
785. Peter Carmichael, Dundee—Improvements in machinery for winding yarn or thread.
786. John Burgess, Rastrick, Halifax—Improvement in dyeing wool.
787. Moses Poole, Serle-street—Improvements in the manufacture of seamless garments and other seamless fabrics.—(Communication.)
788. William Williams, Birmingham—Improvements in electric telegraphs.
789. George P. Tewksbury, Boston, U.S.—Improved life-preserving seat.
790. Benjamin Nickels, 13 Albany-road—Improvements in the manufacture of adhesive plaster.
791. Richard K. Day, Plaistow, Essex—Improvements in the manufacture of fuel for lighting fires.
792. Charles de Bergue, Dowgate-hill—Improvements in the permanent way of railways.
793. John R. Johnson, Hammersmith—Improvements in the manufacture of type or raised surfaces for printing.
794. Moses Poole, Serle-street—Improvements in cementing matters in the production of ornamental and other forms and surfaces.—(Communication.)
795. Henry Bessemer, Old-street, Pancras-road—Improvements in apparatus for concentrating cane juices and other saccharine solutions, and in the treatment of such fluids.
796. Henry Bessemer, Old-street, Pancras-road—Improvements in the crystallization and manufacture of sugar.
797. Henry Bessemer, Old-street, Pancras-road—Improvements in the treatment of washed or cleansed sugar.
798. Jean J. J. Pierrard, Paris—Improvements in preparing wool and other fibrous substances for combing.
799. Henry Bessemer, Old-street, Pancras-road—Improvements in apparatus for concentrating saccharine fluids.

Recorded November 20.

800. Richard Taylor, Newton-heath, Manchester—Improvements in heating dye-cisterns and soap-cisterns, used in the process of calico-printing.
801. John Trestrail, Southampton—Improvements in raising sunken vessels or other materials from under the water or in the sea, or to prevent them from sinking.
802. John B. Collins, Birmingham—Improved flooring-cramp or lifting-jack.
803. James Nasmyth, Patricroft, Manchester—Improvements in machinery or apparatus for packing and compressing cotton, wool, and other substances.
804. Thomas Ellis, sen., Tredegar Iron Works, Monmouthshire—Improvement or improvements in constructing a metallic band or bands for raising and lowering heavy weights, and other like purposes.
805. Joseph Edwards, King's College—Improved envelope, and the means of affording additional security to the same.
806. William Dray, Swan-lane—Improvements in machinery for crushing, bruising, and pulverising.
807. Charles Goty, Rathbone-place, Oxford-street—Improvements in pumps for raising and forcing liquids.
808. George Wilson, York—Improved manufacture of glass bottles and jars.
809. William Green, Islington—Improvements in the manufacture of textile fabrics, and in machinery or apparatus for effecting the same, parts of which improvements are also applicable to printing and embossing generally.

Recorded November 22.

810. Edwin Bates, 7 Great Portland-street—Invention of the revolver, a perfect self-righting, whale-fishing, pilot, or other boat, to be called "Bates' Life-Boat." (No. 1 of a series of naval architecture.)
811. Benjamin Walker and William Bestwick, Salford—Improvements in the manufacture of braid, and the machinery or apparatus employed therein.
812. William Crosskill, Beverley—Improvements in clod-crushers, or rollers for rolling, crushing, or pressing land.
813. John Weems, Johnstone, Renfrewshire—Improvements in obtaining motive power.
814. Robert Heggie, Kirkcaldy—Improvements in railway brakes.
815. John W. Lea, Worcester, and William Hunt, Stoke-Prior—Improvements in the manufacture of iron.
816. William E. Newton, 66 Chancery-lane—Improvements in the manufacture of paper.—(Communication.)
817. John Pepper, jun., Portsmouth, New Hampshire, U.S.—Improved machine for knitting ribbed work.
818. William Hedges, Streatham Hill, Surrey—Improvements in carriages.
819. James Roose, Birmingham—Improvements in the manufacture of welded iron tubes.
820. Samuel Hunter, Gateshead—Improvements in anchors.
821. Joseph Blain, Paris, and 16 Castle-street, Holborn—Invention of a new system of corking.

Recorded November 23.

822. George Eade, 33 Stanhope-street, Hampstead-road—Surface and subaqueous floating breakwater, the invention of Andrew Thorndike, Cassel, Germany.
824. John Winter, Bradford—Improvements in the mode of combining bars of iron so as to form larger masses or pieces of iron, applicable in the manufacture of axles, shafts, columns, beams, cannon, and other articles.
825. John Winter, Bradford—Improvements in the manufacture of wheels.
826. Francis B. Frith, Salford—Improvements in machinery or apparatus for dressing, machining, and finishing velvets, velveteens, cords, beaverteens, and other similar fabrics, composed of cotton, silk, wool, and other fibrous materials.
827. John Kilner, Thornhill Lees, near Dewsbury—Improvements in the means of insulating the wires of electric telegraphs.
828. Michael L. Parnell, Little Queen-street, Holborn—Improvement in the construction of box staples and striking plates.
829. John E. Grisdale, 2 Bloomsbury-street, Holborn—Improvements in steering ships or vessels.
830. James Armitage, Bury, and Charles Thaxter, Fenton—Improvements in dies for moulding plastic materials.
831. William E. Newton, 66 Chancery-lane—Improvements in the construction of and method of applying brakes to railroad carriages, engines, and tenders, for the purpose of preventing collisions.—(Communication.)
832. John Beale, East Greenwich—Improved arrangement of steam-engine, and an improved packing to be used therein.
833. John Frearson, Birmingham—Improvements in the manufacture of hooks for garments.
834. Charles Watt, Brompton—Improvements in obtaining currents of electricity.
835. John Barker, Richmond—Improvements in separating gold from quartz, or matters containing that metal.

Recorded November 24.

836. William Oldham, Southam—Improved dibble drill.
837. Augustus T. Forder, Leamington-Priors—Improvements in fenders for railway carriages.
838. James Carter, Trump-street—Improvements in the manufacture of certain articles of dress or apparel.
839. James Higgin, Manchester—Improvements in the manufacture of certain mordants, used in preparing woven or textile fabrics for printing, staining, or dyeing them, and in the mode or method of using the same or other mordants for the said purposes.

840. John Gedge, Wellington-street, Strand—Improved self-regulating artificial incubator.—(Communication.)
841. Peter Armand le Comte de Fontainemoreau, 4 South-street, Finsbury, and Paris—Improvements in machinery for manufacturing fishing and other nets.—(Communication.)
842. Augustus Brackenbury, Camden-town—Electrifying machine, of materials not hitherto used for such a purpose.
843. Henry R. Caselli, Deptford—Improvements in the construction of anchors.
844. Richard Greenwood, Sutton—Improvements in warming the upper rooms of houses.
845. John R. Cochrane, Glasgow—Improvements in the manufacture or production of ornamental or figured fabrics.
846. Joseph H. Combres, Paris—Invention for preventing the ill effects of dampness in walls and dwellings.—(Communication.)
847. Henry Thomson, Clitheroe—Improvements in apparatus to be used in dyeing, bleaching, and other processes in which goods are operated upon in the piece.
848. Charles Finlayson, Manchester—Improvements in apparatus for heating, drying, and ventilating.
849. Achille Jean Louis Hypolite Tourteau Comte de Septeuil, Paris—Improvements in the construction of electro-magnetic engines and in batteries.
850. William H. Winchester, Tamerton Foliott, and Berners-street—Improvements in splints.
851. William Wilkinson, Nottingham—Improvements in the manufacture of looped and textile fabrics, and in machinery for producing the same.
852. Alphonse Joly, Paris—Certain improvements in steam-engines.
853. Stephen Spalding, Hogsthorp—Apparatus or machine for the manufacture of pantiles used in building purposes.
854. Edward Aitchison, Chelsea, and John Evans, 8 Hamilton-street, Wandsworth-road—Improvements in furnaces.
855. Robert M. Glover, Newcastle-upon-Tyne—Improvements in coating the bottoms and other parts of ships and vessels, in order to prevent animal and vegetable growth in contact therewith.

Recorded November 25.

856. Richard Dudgeon, New York—Invention for raising heavy weights, by means of a portable hydraulic press.
858. John Tatham and David Cheetham, Rochdale—Improvements in machinery or apparatus for preparing, spinning, and doubling cotton and other fibrous substances.
859. Thomas Bennett, West Bromwich—Improvements in heating air for blast furnaces.
860. William Hall, Nottingham—Improvements in rotary steam-engines, governors, and apparatus for supplying boilers with water, and for regulating the same.
861. James Murdoch, Staple Inn—Improved machine for shaping staves for casks, vats, and other similar vessels.—(Communication.)
862. Andrew Jeffrey, Chirnside—Improvements in reaping machines.
863. Henry Holland, Birmingham—Improvements in the manufacture of umbrellas and parasols.
864. Maximilian F. J. Delfosse, Moorgate-street—Improvements in preserving wood, stuffs, and other fabrics, and in rendering them uninflammable.—(Communication.)
865. Charles Harford, Down-place, Windsor—Improvements in rotatory engines.
866. James Robertson, Glasgow—Improvements in furnaces or fire places.
867. Charles Iles, Birmingham—Improvements in the manufacture of chimney-pieces.

Recorded November 26.

868. Amédée F. Rémond, Birmingham—A new or improved lock.—(Communication.)
869. Adam Ogden, Huddersfield, and John Ogden, Ashton-under-Lyne—Improvements in machinery for spinning cotton or wool.
870. James W. Hoby and John Kinniburgh, Renfrew—Improvements in the manufacture of metal castings.
871. James Taylor, Birkenhead—Certain improvements in and applicable to floating graving-docks for repairing and building ships.
872. Auguste E. L. Bellford, 16 Castle-street, Holborn—Improvements in the manufacture of bricks.—(Communication.)
873. Charles C. Glover, Paris, 16 Castle-street, Holborn—A system of stoppering instantaneously bottles and other vessels used for containing aerated liquids.
874. Paul Sormani, Paris, and 16 Castle Street, Holborn—Improved travelling case.
875. Armand J. C. Hudault, Paris, and 16 Castle-street, Holborn—Improved leaven.
877. Thomas A. Cook, Wall's-end—Improvements in bleaching.
878. Thomas C. Medwin, Blackfriars-road—Improvements in water-guages or instruments for indicating the height of water in boilers.
879. Jean A. Oudart, Paris—Improvements in presses for obtaining copies of letters, and other like purposes.
880. Alexander Turiff, Paisley—Improvements in moulding or shaping metals.
881. Henry B. Condy, Battersea—Improvements in the manufacture of acetic acid and acetates.
882. Antonio F. Cossus, University-street—Improvements in lubricating apparatus.
883. William Massingham, Ipswich—Improvements in carriages and apparatus for carrying the dead.
884. Robert B. Feather, Liverpool—Improvements in the construction of ships, and in rendering ships and boats impervious to shot.
885. George A. Huddart, Brynkir—Certain improvements in tools for cutting or abrading metallic and other surfaces.
886. Edwin L. Brundage, Jewin-crescent—Improvements in apparatus for drawing off fluids from animal bodies.—(Communication.)
887. Thomas Wood, Leeds—Improvements in the mode of obtaining motive power.
888. George A. Huddart, Brynkir—Improvements in facilitating combustion in steam-boiler furnaces.
889. George A. Huddart, Brynkir—Improved manufacture of artificial flies.
890. Mathurin J. P. Moriceau, Paris—Improvements in sharpening and dressing the cards of carding-machines, and the clippers and cylinders of shearing machines.

Recorded November 27.

891. Harry Winton, Birmingham, and Francis Parkes, Coldfield-park, Warwickshire—Improvements in the manufacture of agricultural and horticultural forks, and pronged or toothed instruments and hoes.
893. John Lotsky, Soho-square—Improved playthings, hereby denominated "Pestalozzian gymnastic playthings."
894. William J. Curtis, Grafton-place, Euston-square—Certain improvements in the formation of tramroads or railroads, and carriages that run thereon.
895. Emile Martin, Paris, and South-street, Finsbury—Certain improvements in the mode of extracting gluten from wheat, and for preparing and drying the same by mixing to several degrees of concentration.
896. John Gilmore, Lombard-street—Improved mode or means of extinguishing fire in ships or other vessels.
897. George Houghton, Birmingham—Improvements in the manufacture of college caps.
898. William E. Schottlander, Southwark—Improvements in machinery for boring the ground, stone, or rocks, for the formation of drains and sewers for the laying of pipes under ground, and for removing obstructions therein; also in the manufacture of pipes to be used in connection with such machinery, and in instruments for surveying and levelling, preparatory to the boring operations.—(Communication.)

Recorded November 29.

899. Frederick Westbrook, Kensington—Improvements in clasps for books.
900. Samuel C. Lister, Manningham, and James Warburton, Addingham—Improvements in the manufacture of yarn from fibrous materials.
901. Thomas Dudgeon, Edinburgh—Improvements in hydrostatical propulsion.
902. William Fowler and William M'Collin, Kingston-upon-Hull—Machine constructed and adapted for a clod-crusher and land-cultivator.
903. William Pink, Fareham—Improved construction of stirrup-bar for saddles.
904. Eugène Nicollo, Birmingham—Improvements in apparatus for damping, cutting, and attaching stamps and labels.
905. Matthew S. Kendrick, Birmingham—Improvements in grates and fire-places.
906. Matthew S. Kendrick, Birmingham—Improvements in lamps and burners, and in the apparatus to be used therewith.
907. Jean D. Schneiter, Paris—Improvements in maps and charts.
908. Francis W. Ellington, Drummond-street, Euston-square—Improvements in the making of screws for collapsible and other vessels.
909. William Brown, Airdrie—Improvements in electric telegraph instruments.

Recorded November 30.

911. John Addison, 1 Baker-street, Portman-square—Invention of ascertaining the hour of the day by means of a pocket sun-dial.
912. William Jeffs, Hulme, near Manchester—Improvements in manufacturing letters, figures, and ornamental work, and in the mode of attaching the same to wood, stone, iron, and certain other materials.
913. James Murdoch, Staple-inn, Middlesex—Improved materials for use in painting.—(Communication.)
914. James M. Haldon, Lime-street—Improvements in the means of rendering wood imperishable and uninflammable.—(Communication.)
915. Samuel Clarke, 55 Albany-street—Improvements in lamps.
916. Allan Craig, Barrhead, near Glasgow—Improved crane, and apparatus connected therewith.
917. John B. Birch and Eugenius Birch, Parliament-street—Improvements in forming drains, and introducing pipes or tubes into the earth.
918. Joseph Skertchley, jun., Kingsland, Middlesex—Improvements in mangles and mangle-rollers.
919. James Barlow, King William-street—Improvements in stands or supports for casks barrels, and other like vessels.
920. Thomas Parramore, Southwark, and Samuel Lewis, Stepney—Improvements in articles of wearing apparel.
921. George Fitt, Chalk, near Gravesend—Invention of obtaining mechanical motive power and speed.

Recorded December 1.

923. Charles Hart, Wantage, Berkshire—Invention of a thrashing, straw-shaking, riddling, and winnowing machine combined.
924. William Slater, Carlisle—Improvements in ovens and apparatus for baking.
925. George A. Huddart, Brynkir, Carnarvonshire—Improvements in the construction of boilers and furnaces for generating steam.
926. Charles Walker, Heap-bridge, near Bury—Improvements in the method of purifying water for steam boilers and other purposes.
927. Robert Milligan, Bingley, Yorkshire—Improvements applicable to combing machinery.
928. William Morris, Westminster—Improvements in the production of motive power, and in apparatus pertaining thereto.
929. Frederick W. Green, Bristol and London—Improvements in the mode of propelling ships and other vessels.

Recorded December 2.

930. John Dable and William Wells, Birmingham—Improvement in rolling metals.
931. Robert Kirke, Llanelly, Carmarthen—Improved grate or apparatus for burning fuel, especially adapted for anthracite coal, whether used under reverberatory furnaces or boilers, or with or without a blast.
932. William Taylor, 16 Oxford-terrace, Hyde-park—Improvements in propelling ships and other floating bodies.
933. James Rothwell, Heywood, near Manchester—Improvements in looms for weaving.
934. William K. Whytehead, 69 Cornhill—Improvements in steam-engines and steam-boilers.
935. James E. M'Connell, Wolverton—Improvements in locomotive engines.
936. John Norton, Cork—Improvements in shot or projectiles.
937. Ebenezer Poulson, Monkwearmouth—Improved mechanical purchase, applicable to working ships' and other pumps, and to similar purposes.
938. Charles Millar, Dundee—Improvements in time-keepers or clockwork, and in machinery or apparatus worked in connection therewith.

Recorded December 3.

939. James Newall, Bury—Improvements in breaks, machinery, or apparatus applied to railway and other carriages in motion, and in the mode or method of connecting two or more of such breaks together.
940. Noble Seward, Caherconlish, Limerick—Improvements in applying hydro-pneumatic agency for obtaining motive power.
941. Thomas C. Banfield, 18 Queen-square—Improvement in the process of and apparatus for extracting saccharine and other juices from beet-root or other roots and plants.—(Communication.)
942. Peter Walker and Andrew B. Walker, Warrington—Improvements in fermenting ale and porter and other liquids.
943. Henry Hitchins, King William-street, and William Batley, Denmark-street—Improvements in producing raised surfaces and imitations of carvings from materials not hitherto similarly applied.
944. Page D. Woodcock, Lincoln—Improved preparation or pill for medicinal purposes, hereby denominated "Page Woodcock's Wind Pills."
945. Cornelius de Bergue, Manchester—Improvements in, and applicable to, looms for weaving.—(Communication.)
946. George Ware, Sydenham, Kent, and Albert H. Fernandez, Newington-crescent—Improvements in the making of wedges or keys for holding or tightening the rails within railway chairs.
947. John Neale, Chatham—Improvements in back fastenings for Venetian and other swing-shutters or blinds, and also for swing-windows and doors.
948. George Stiff, Christchurch-road, Brixton-hill, Surrey—Improved construction of printing machine.
949. John Bethell, Parliament-street—Improvements in machinery or apparatus for digging and cultivating land.
950. John Bethell, Parliament-street—Improvements in steam-engines.
951. Arthur Wall, East India-road—Improvements in preparing sheet-metal for ship-building and other uses.
952. Duncan M'Nee, Kirkintilloch—Invention of a machine for printing with colours on cloth, and which is also applicable for printing ornamental designs on paper.
953. Richard A. Brooman, 166 Fleet-street—Improvements in the manufacture of sugar.—(Communication.)

954. Samuel Neville, Gateshead—Improvements in the manufacture of lamp-glasses and globes.
955. William Keates, Liverpool—Improvements in fire-boxes for locomotive and other steam-boilers.

Recorded December 4.

956. John T. Manifold and Charles S. Lowndes, Liverpool—Improvements in the method of extracting the juice from the sugar-cane.
957. John Rowbotham, Manchester—Improvements in time-keepers, and apparatus connected therewith, for ascertaining the attendance on duty of watchmen and other persons having charge of property.
958. Alexander Lawrie, Chatham—Improvements in the manufacture of oars and similar articles.
959. James Murdoch, Staple-inn, Middlesex—Improved galvanic battery.—(Communication.)
960. Joseph Bentley, Liverpool—Improvements applicable to fire-arms.
961. Joseph Cliff, Wortley—Improvements in the mode of making and compressing bricks, lumps, tiles, quarries, terra cotta, and other similar articles.
962. William Maugham, Ifield-terrace, Surrey—Improvements in rendering wood fire-proof.
963. George F. Parratt, Piccadilly—Improvements in portable bridges or pontoons.
964. Isac L. Pulvermacher, Paris—Improvements in pipes and cigar-holders.

Recorded December 6.

965. Denis J. Murphy, Cork—Improved agricultural machine, which he calls the "Archimedean Agricultural Machine."
966. James Buchanan, Glasgow—Improvements in the treatment of flax and other similar vegetable fibrous substances, and in the machinery employed therein.
967. Richard A. Brooman, 166 Fleet-street—Improvements in saws and saw-mills.—(Communication.)
968. Guillaume F. de Douhet, Paris—Improvements in the manufacture of alcoholic, saccharine, and starch products.
969. Andre J. A. Gautier, Paris—Improved treatment of peat.
970. Asa Lees and Thomas Kay, Oldham—Improvements in machinery for spinning and doubling cotton, wool, silk, flax, and other fibrous materials.
971. Frederick M. Gooch, Bolton-le-Moors—Improvements in the construction of railway signals, and in machinery or apparatus for working railway signals.
972. Charles A. Jordery, Paris—Improvements in the construction of the bodies of cravat collars, and stocks and stiffeners, and in the ornamenting of cravat collars and stocks in general.
973. Richard Laming, Poplar—Improvements in purifying gas, and in obtaining from the products resulting from the purification of gas certain useful compounds.
974. Edward Tucker, Belfast — Improvements in the manufacture or production of starch.
975. William Paton, Johnstone—Improvements in the manufacture of driving bands for machinery.
976. John Norman, Liverpool—Improvements in the mode of making and setting the square sails of ships or vessels of any size and description.
977. William Blackett, 227 Blackfriars-road—Improvements in steam boilers.
978. James Smith, 2 Little Canterbury-place, Lambeth-walk—Improvements in paving roads and other surfaces.
980. Thomas Conolly, Hanover-square, London, and William Cotter, Nottingham—Improvements in propelling vessels.

Recorded December 7.

981. Pierre Duchamp, Lyons, temporary of Paris—Improved Jacquard machine.
982. Peter Armand Lecomte de Fontainemoreau, 4 South-street—Improvements in constructing the bars of furnaces and grates.—(Communication.)
983. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in weaving carpets and other fabrics, and in the machinery or apparatus employed therein. —(Communication.)
984. Thomas Challinor, Bolt-court, Fleet-street — Improvements in apparatus to be applied to decanters and other bottles, to facilitate the running off liquids therefrom.
985. William Mayo, Berners-street - Improvements in balls or float-valves and cocks.
986. James Norton, Ludgate-hill—Improved mode of transmitting motive power.
987. Alfred V. Newton, 66 Chancery-lane—Improved mode of transportation for the conveyance of letters, packages, freight, or passengers, from one place to another.—(Communication.)
988. Samuel A. Goddard, Birmingham—Improvements in the construction of pistols.
989. Richard A. Brooman, 166 Fleet-street—Improvements in safety-valves.—(Communication.)
990. Richard A. Brooman, 166 Fleet-street—Improvements in machinery or apparatus for heating, evaporating, torrefying, distilling, and refrigerating.—(Communication.)

Recorded December 8.

991. Thomas L. Preston, Birmingham—Invention of a machine for making links for chains.
992. John Brown, Charles-street, Regent-street—Improvements in machinery or apparatus for preventing the escape of smoke from chimneys, and consuming or otherwise disposing thereof.
995. John Harrison, Robert Harrison, and Alexander S. Harrison, Dromore, county Down—Improvements in machinery used in the manufacture of textile and other fabrics.
996. John Symonds, Glasshouse-yard, East Smithfield, and George Mouchet, Battersea—Improved mode of cleaning or scaling metallic surfaces.
997. William Baddeley, Islington—Improvements in apparatus for the conversion of rectilinear into circular motion.—(Communication.)
998. Donald Beatson, Mile-end, and Thomas Hill, Southampton—Improvements in the means of propelling ships and other floating vessels.
999. Thomas Hill, Southampton—Improvements in paddle-wheels for propelling ships and other vessels.
1000. James Lawrence, Westminster—Improvements in the manufacture of projectiles.
1001. Anthony N. Groves, Madras, and Conrad W. Finzel, jun., Bristol—Improvements in condensing steam or vapours.
1002. James S. Wilson, Tavistock-place—Improvements in propelling.
1003. Sir John P. Orde, Lochgilphead—Improvements in head-gear for horses and other like animals.
1004. Joseph Hopkins, Worcester—Improvements in obtaining a straight line parallel to the axis of the earth, or in rendering the axis of a tube or of a telescope parallel thereto.

Recorded December 9.

1007. William Mather, Manchester—Improvements in the method of spreading medicinal compounds upon leather, to be used as plasters, and in the machinery or apparatus connected therewith.
1008. William Baddeley, 13 Angell-terrace, Islington—Improvements in the manufacture of metal pipes.—(Communication.)
1009. William Allchin, Northampton—Improvements in agricultural and other steam-engines.
1010. Edmund Hunt, Glasgow—Improved screw-propeller.
1011. Edward T. Loseby, Gerrard-street, Islington—Improvements in the construction of timekeepers, and in cases to be applied thereto.
1012. Charles Greenway, Cheltenham—Improvements in anchors.
1013. George Collier, Halifax—Improvements in the manufacture of carpets and other fabrics.
1014. Thomas Masters, Oxford-street – Improvements in machinery or apparatus for cleaning knives and other steel articles.

☞ *Information as to any of these applications, and their progress, may be had on application to the Editor of this Journal.*

ENGLISH PATENTS.

Sealed from 13th November, to 21st December, 1852.

Auguste Edouard Loradoux Bellford, Castle-street, Holborn,—" Improvements in the construction of springs for railway and other carriages."—(Communication.)—November 25th.

Moses Poole, London, gentleman,—" Improvements in the elastic ribs, sticks, strips, and fillets used in the manufacture of umbrellas, parasols, and various other articles in substitution of whalebone and steel heretofore employed."—(Communication.)—27th.

Lewis Pocock, Gloucester-road, Regent's-park, Middlesex, gentleman,—" Improvements in rendering sea and other water pure."—27th.

Pierre Jules Lamaille, Paris, manufacturer,—" Certain improvements in the preservation of japanned leather."—December 1.

William Gorman, Glasgow, engineer,—" Improvements in obtaining motive power, which improvements, or parts thereof, are applicable for measuring and transmitting aeriform bodies and fluids."—8th.

William Hodgson, Skircoat, York, engineer,—" Improvements in the manufacture of woven, textile, and looped fabrics, and in the machinery employed therein."—N.B. This patent being opposed at the Great Seal, was not sealed till December 15, but bears date the 30th of September last, the day it would have been sealed but for the said opposition.

George Shaw, Birmingham,—" Certain improved machinery for making envelopes and bags."—(Communication.)—17th.

Robert Burn, Edinburgh, practical engineer,—" A certain improvement in steam-engines."—21st.

Robert Galloway, Cartmel, Lancaster,—" Improvements in manufacturing and refining of sugar."—21st.

DESIGNS FOR ARTICLES OF UTILITY.

Registered from 16th November, to 21st December, 1852.

Nov. 17th,	3390	William Redgrave, Grafton-street, Fitzroy-square,—" Cricket guard."
22d,	3391	James Horsfall, Birmingham,—" Annealing-pot."
24th,	3392	Thomas Crump, Derby,—" Self-acting service-cistern for water-closets."
26th,	3393	F. G. Yates, East-road, City-road,—" Winder for string boxes."
—	3394	T. Fallows, Manchester,—" Connector of flyers to spindles."
29th,	3395	J. Toulmin, Size-lane, City,—" Despatch-box."
Dec. 9th,	3396	W. Mitcheson & Sons, Limehouse,—" Anchor."
10th,	3397	John Worrall, Sheffield,—" Tackle."
—	3398	Thomas Carr, Manchester,—" Spinner's bobbin and nail coat."
13th,	3399	John C. Boucher, Birmingham,—" Coat."
14th,	3400	Frederick Johnson and William Farrar, Castle-street, Holborn,—" Venetian ventilator."
21st,	3401	Henry Harrison, King's-road, Hoxton,—" Portable tent, or sleeping cabin."
—	3402	W. and F. Thorn, John-street, Oxford-street, —" Equimotive spring."

DESIGNS FOR ARTICLES OF UTILITY.

Provisionally Registered from 23d October, to 22d December, 1852.

Nov. 12th,	477	Richard Watkins, Hereford-cottage, Dalston,—" Pen reservoir."
26th,	478	P. D. Nolet, Castle-street, Holborn,—" Compressing apparatus."
Dec. 7th,	479	Mrs T. Groom, Sussex-terrace,—" Elastic self-supporting infant's belt."
8th,	480	H. Masters, Bristol,—" Apparatus for heating by gas."
10th,	481	William Redgrave, Rickmansworth,—" Railway cap."
15th,	482	N. A. Bertsch, Castle-street, Holborn,—" Photographical obturator."
17th,	483	T. Smith & Son, Birmingham,—" Pressure cone-tightener for looking-glasses and other swing frames."
22d,	484	E. Smallwood, Fenchurch-street,—" Boarding for packing-cases and cottages."

TO READERS AND CORRESPONDENTS.

Pernambuco Sugar-Mill.—A correspondent says—" I observe in the newspapers glowing accounts of what is termed, a new, simple, and highly effective sugar-mill, now in common use at Pernambuco; but I have reason to be doubtful of the machine's reality. Can any of the readers of the *Practical Mechanic's Journal* give us news of it? I presume it is a Dutch production."—[We ourselves presume the invention referred to, to be that patented by Mr. Mornay of Pernambuco, August 5, 1851. We have not heard, however, that it is of much value. Mr. Mornay's plan consists in an arrangement of crushing-rollers, combined with smaller feed-rollers, in such a manner as to prevent the juice from being re-absorbed by the megass, the latter being made to *ascend* after each squeeze. An improvement on Mr. Bessemer's plunger-press is also proposed, consisting in having that part of the tube near the plunger with diverging, instead of parallel sides. Mr. Mornay further claims the use of a series of wires, placed along a shallow-inclined evaporating-pan, at a slight distance from the bottom—so that, as the juice runs down, it is intercepted, and, being well mixed up with air, is more rapidly evaporated.]

Vulcan.—The injured party has an undoubted ground for legal redress, but the proceeding would be most troublesome and annoying. He may proceed by an action for fraud, or by a writ of *scire facias*. There are no other remedies. Written agreements are always essential in cases of this kind.

Received.—" A Treatise on the Screw Propeller." By John Bourne, C.E.—" On the Connection of Atmospheric Impurity with Disease." By H. M'Cormac, M.D.—" Moral Sanatory Economy." Same Author.—" Transactions of the Royal Scottish Society of Arts." Vol. IV., Part I.—" A Word in Season; or, How to Grow Wheat with Profit," &c. Tenth Edition.—" Papers relative to the Address from the Women of England on Slavery in America."—" Millwright and Engineer's Pocket Companion." By W. Templeton.—" Dupuis' Measurer."

F. H. B., Exeter.—Nothing that really deserves notice has yet been done. Flying reports occasionally come from questionable quarters, but we are yet as far as ever from the solution of the question of commercial practicability.

J. T., St. Vincent.—This communication is being arranged for publication next month.

INDUSTRIAL EDUCATION.

It appears that Dr. Playfair, being desirous of personally observing the present state of industrial education on the Continent, has employed his recent season of leisure in visiting some of the principal institutions in Prussia, Saxony, Austria, Bavaria, Baden, France, and Belgium, and has collected a mass of information, which he has thrown into the readable shape of a lecture, printed after recent delivery at the Government School of Mines and of Science applied to the Arts.

He commences with a few pages of very agreeable discourse on the intellectual element of production on the Continent; and then successively, succinctly, and sufficiently in detail, exhibits the present means towards industrial education existing in Prussia, &c. The discourse being thus of so analytical a character, and necessarily abounding in statistics, precludes our doing more than notice the general bearing of the subject, which is now admitted by almost all persons to be one claiming, and proper to receive, the very best attention of every British subject. An appendix, giving very minute details of the courses of instruction in the Trade Institute of Berlin; the Polytechnic School of Saxony; that of Vienna; in the schools of Nuremberg, Augsberg, and Munich; in the Ecole Centrale des Arts et Manufactures in Paris; and in the Technical Institute of Copenhagen—is a very useful addendum; and the facts appearing in it, we doubt not, will prove as useful as a Council of Ministers to those who are in authority over us in these matters.

A history of schools, treated by a competent individual, would form an instructive and interesting record. It would be very different from other histories. In them, the results of thought form the topics of observation and comment; in these, the very thought itself, of the most cultivated men of every age, would be the proper subject-matter. The necessarily meagre sketch with which Dr. Playfair introduces his particular remarks on the individual countries is of high interest, and points out, to the slightest attention, the great movement which is now going on in educational views, and the natural forces which have put it in motion.

It was necessarily long before the proper kind of education was perceived, if, indeed, we are now right in our present views. Both Germany and France have felt the evil of this state of things. *Some* education, and that of a high class, was, doubtless, the right thing to be instituted, and the tradition of the ages naturally favoured the abstract, physical and mental philosophy. This, accordingly, was adopted; but, as we are informed, large numbers of men were thus reared, for whom the channels of industry offered no outlet; they naturally pressed upon the Government, which had stimulated them to acquire abstract knowledge, and a gigantic bureaucracy was forced upon the State. The evil, continues Dr. Playfair, increased to such an extent, that, in some States in Germany, 60 out of 1000 of the population were in Government employ. This enormous error could not but be perceived by many, and what is termed the "Real" system of education then arose in Germany, and is extending, with all the force of a natural and appropriate power. "In the schools professing this system, the realities of modern life are taught in preference to the languages and customs of the classical ages." The Real schools, however, were found not sufficient to give a quick impulse to industrial development, and a third class of school arose—the widely-extending "*Gewerbe*," or Trade schools—which have themselves originated the Polytechnic institutes, or Industrial universities.

"Labour is of two kinds, corporeal and mental, or, as Mr. Mill calls it, muscular and nervous." Now, this is a definition which we never have liked, and never shall like. It is of the last importance to its correctness to distinguish the two; and who is he who has, except in a rough and rude way, even attempted to do so. Labour is not of two kinds, but essentially of one kind only, *performing, however, its functions in different ways*—precisely in the same way as silica, sand, flint, and rock crystal are but designations of the same chemical compound (*silicic acid*), occurring in different physical conditions. This is not a dispute about words, but about essence—a dispute touching, and rightly touching, the very marrow of all our speculations. We must now, however, abstain from pursuing the subject further, as, beyond a hint, it would plunge us into greater space than we can at present appropriately devote to it.

One mode in which labour operates is in originating new forms, and new combinations of known forms. It is thus the very capital of the inventor, whether his invention lies in the actual construction of a machine, or the production of a design. It is *not* what it, nevertheless, has sometimes been termed, in the pet phrase of the day (adopted even by our highest authorities), a sort of raw material, but is rather a power acting upon raw material, whatever that raw material may be, whether the, as yet, unprinted piece of cotton, or the last perfected thought of an intelligent brain. It is requisite, therefore, that great attention should be directed to the increase of this power. And one of the means adequate to the production of such increase, and open to all nations—to all individuals—is in the establishment of those institutions, which we would unite with others in upholding to imitation.

Dr. Playfair says, "The whole of industrial competition is now resolved into a struggle to obtain a *maximum* effect by a *minimum* expenditure of power." What is here intended to be expressed would be more intelligible and simply true in other words; and we would urge, that the whole of such competition is attributable to a desire, participated in by many, to obtain a higher by means of a lower power—which, regarded rightly, is but another mode of expression for saying, that it results from a desire generally felt to increase power. Brute strength is a natural power, and not the lowest in the class of powers; but how immensely may this power be increased by the proper combination of a few pieces of metal, a little water, and a little fire!

"Production, as understood in political economy, consists in the formation of utilities out of objects which, either from their position or form, were of little use until subjected to the operations of industry." This definition being well grasped and held fast, and applied by the mind in a progressive shape, is capable of forming a *point d'appui* for all reasoning in favour of an industrial education in the arts of life. And this is the most legitimate, as the most extended, method of knowing what production truly is. To produce more now than was produced before, is the very lowest way of looking on the subject; but to produce things of better and better *quality*, physical and æsthetical, it is, alone, that can keep us in a moving state, and by which all our powers may grow in grace, as in stature. Hitherto, for this production, England has solely relied upon the experience of her working men—meaning by the term experience, as Dr. Playfair uses the word, that empirical knowledge which arises in the growth of practice. Foreigners had, up to a certain period, likewise, solely relied upon this. It is natural to do so. Art ever precedes science. But they, during the last few years, have advanced a few steps onwards out of the path we are still pursuing; and, eliminating general principles out of the facts of experience, have commenced teaching such principles, with such acknowledged success too, as shown in 1851, as to make us look about us, if we are desirous of retaining our place as producers for the world.

"In this country we have eminent 'practical men,' and eminent 'scientific' men; but they are not united, and generally walk in paths wholly distinct. From this absence of connection, there is often a want of mutual esteem, and a misapprehension of their relative importance to each other. The philosopher is apt to undervalue the dignity of productive industry, while the practical man sees, in the absence of utilities, only the visionary speculator." These words are equally true and important: and it is to combine more and more intimately the practical and the scientific man—the dexterous hand and the thoughtful mind—that we are now, in all the principal places in our realm, endeavouring to establish the Industrial schools. For, it is not left to mere probability, or to inference only, but attention, carefully bestowed, can readily *see*,

that, when these advantages are combined, *there* production is in its higher form, and that the anomalies which are thrust before us, even in our daily walks, or which we are compelled to notice in our daily avocations, are the simple result of the isolated separation of those advantages.

The whole question of industrial education resolves itself into this one:—Is it better, or not, that the producer of the intended form should understand well the nature of the material (in its extended sense) upon which his industry is exercised, and the natural principles within which all manipulation of it must be confined, or may be extended? There can but be one reply. The foreigner has, before us, answered this question, and has long been acting upon it, and, being invited to the Great Exhibition, demonstrated within its area the correctness of his views; while the British workman has been contented to plod on, as his forefathers, with suicidal self-complacency, in those conventional actions of the fore-arm, the wrist, and the fingers, which have certainly elevated him into the rank of the *largest* producer. We are reminded, on all hands, that the object of Industrial schools is only to teach a pupil how to become an *intelligent* manufacturer, without attempting the impossibility of making him one. They simply content themselves with communicating to him a knowledge of the principles upon which his technical art depends; "for its practice he must go to the workshops of industry." They thus enable him to go there with greater power at command, the successful employment of which must obviously depend upon many more contingencies than the elementary school can furnish. They simply tell the workman, that he must receive "more of a scientific, and less of a rule-of-thumb education."

"Only a few months since, M. de Cocquiel (from Belgium) made an educational tour in this country on behalf of the Government, and he could not conceal his astonishment at the character of the instruction with which we had contented ourselves, in this country of production." And his astonishment is not to be wondered at; for, let us but analyse this instruction, and trace the history of our present position, and we shall find, that the instruction is scarcely anything more than mechanical (in the lowest sense of the term), and that the general excellence of our production is attributable almost solely to a quick natural eye catching some accident. This is clearly not as it should be. Our youth requires something more than, or different from, a little Latin, and less Greek, still less French and German, "the first six books of Euclid," and the ability to write a line of round hand, to fit him for the workshop. All these, and much more, do the continental authorities perceive, are requisite to enable him to enter on preliminary study for his business or profession; and matriculation-examinations are in most cases, consequently, required to be passed through creditably, before he is permitted to commence a course of discipline in principles, the knowledge of which is essential to aid his earlier or better success. It is but lately that our colleges have required such an examination even for the course of classical and purely mathematical studies, chiefly conducted in them. But the principle is applicable to all special studies, and no doubt will now, for the future, be applied accordingly.

How like a piece of eloquent poetry do the following few words strike one!—"Every new acquirement in the knowledge of natural forces is the acquisition of a new sense." This speaks a volume of sublime thought, for it is capable of being extended, as each particular mind, with its all or little of learning. And why is this? What reason can be adduced but that it is because every new acquirement of such knowlege is, in fact, the acquirement of increased power? How justly and intuitively Bacon thought upon this point is seen in almost every page of his writings, in which we are often reminded, that the knowledge and power of man are coincident, and when a language was not yet formed for him wherein to express his meaning more clearly. It is this which we would maintain to lie at the basis of all argument for the establishment of institutions, where the statics and dynamics of nature may be first studied in their simplicity, and exemplified by the most improved things of the age for the time being, so as to form, as it were, the tools to work out other things, of utility and beauty, hitherto unknown.

It is obvious that improvements, which are the result of experience alone, must, as the demands and tastes of man vary, be continually laid aside, as the history of most arts, preserved in the unperished records of actual ancient manufacture, tells us they must have been; and not only so, but afterwards entirely forgotten. It is not thus with the results of scientific observation, and the formulæ which it introduces. Such formulæ become, as it were, a refined method of printing, by which all discoveries are capable of being transmitted to after-ages. Dr. Playfair calls the latter the *growing* element of production—the former, the *decreasing* one; and proclaims, as with a hundred voices, how we are vainly still clinging to our dying paths, while the Continent is eagerly and rapidly seizing upon the living form traversing them.

In pursuing our course through the mass of facts which have been, on this subject, collected together, we have been greatly struck with the facilities which are afforded on the Continent, in addition to others, for the study of that particular branch of art-science to which our columns are devoted. In almost every one of the schools abroad, a special class for mechanics is organised, in which the study is directed to machinery in an extended course—materials used in machines, separate parts of machines, machines used in building, composite machines, steam-engines, and other machines driven by power—practice in projection, railways and buildings, technology, and practice in the machine-workshop. It is needless to predict how the education of the masses, thus fostered, must terminate in some future brilliant applications, of which we have as yet no conception It is to be hoped that the lesson thus being taught to us will not be unheeded, and that the whole nation will at once see it to be our interest, as well as our duty, to encourage similar institutions in our own country.

We have, in the pamphlet giving occasion for these observations, details, at considerable length, of the constitution and course of studies pursued at the Polytechnic school of Carlsruhe, as being, "perhaps, the most efficient one in Germany, and, in its organisation, "probably more nearly allied to any similar institution that might arise in this country;" and we would ask our readers to consult, on this part of the subject, the pages alluded to, in which some very significant facts occasionally come out. Thus we are told, that the Trade Institute of Berlin annually costs the State £7000; of which £1500 are devoted to the support of poor pupils, and £1000 are spent in travelling expenses, both professors and students being occasionally sent to foreign countries, to acquire a knowledge of recent inventions and new industrial improvements! We shall revert to this subject.

ON THE ARRANGEMENT OF THE MATERIALS, AND THE APPLICATION OF THE WASTE GASES IN BLAST FURNACES.

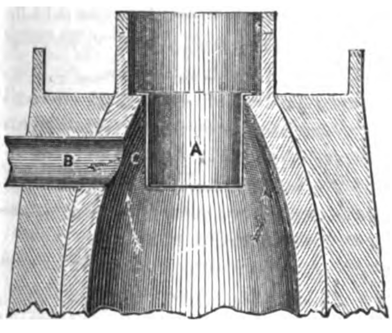
To Mr. Budd of Ystal-y-Fera, as we have already told the readers of the *Practical Mechanic's Journal*,* must be accorded the credit of having first practically employed the waste gases of iron-smelting furnaces for economical purposes in this country, although the system is of much older date on the continent. Many difficulties were met with in the Welsh experiments, as, in the first instance, the flame, and not the actual gases, was taken off, so that not only was a large proportion of the heat wasted, but the parts of the apparatus acted on by the flame were constantly getting out of order from the effects of the excessive heat. This led to such modifications of the apparatus, that the unignited gases could be drawn off for burning at the exact spot required. How this was at first done, and through what stages the system was subsequently carried, has been well explained in Mr. Blackwell's excellent paper, read at the October meeting of the Institution of Mechanical Engineers. The Ystal-y-Fera plans have already been illustrated in these pages; so also have Mr. Houldsworth's arrangements at the Coltness Works in Scotland; and we now follow up the subject with an account of the proceedings taken at Ebbw Vale, Cwm Celyn, Bilston, Dundyvan,

* Page 12, Vol. II.

and Pontypool Works, being a collection of Welsh, Staffordshire, and Scottish experiences.

Fig. 1 is a vertical section of the upper part of a furnace, showing the mode first tried at Ebbw Vale. A flanged iron cylinder, A, open at both ends, was suspended in the top of the furnace, its lower end projecting down to near the level of the lower side of the discharge passage, B. In this way, a quantity of gas was collected in the annular space, C, outside the cylinder, A, into which space no atmospheric air could penetrate so long as a body of gas issued in the usual way through the open cylinder; and the contrivance was successful, although the gases still passed off in a very hot state, and a powerful draught was necessary to take off the gaseous current, and the quantity of gas really secured was trifling, in comparison with that which passed away through the open cylinder.

Fig. 1.

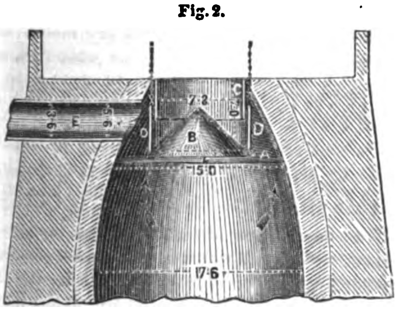


1-192d.

In 1849, some Derbyshire furnaces, from which the gases were taken to heat the blast, were placed under Mr. Blackwell's care. Here, so long as the heat was maintained with regularity, the furnaces worked very satisfactorily; but the requisite uniformity was difficult to keep up, for, with the wind in certain directions, a regular discharge of gas was impossible; and when it did come in abundance, it was mixed with air, and, therefore, burned the ducts. Mr. Blackwell, therefore, adopted a wrought-iron cylinder, as in fig. 1, for covering the opening into the gas flue. The furnace tops were small, admitting only of cylinders of 4½ and 6 feet; and although the plan succeeded, the smaller furnace began to "scaffold" and slip; and, worse than this, the tuyeres gave a deal of trouble, whilst the produce fell off in a most decided manner. After an extended trial, the cylinder was taken out, and other means were adopted to prevent the gaseous ignition, and the furnace at once assumed its original regularity. The furnace with the 6-feet cylinder worked better, but was finally altered in a similar manner, the modified form being very like that shown in fig. 6. Since this time, both furnaces have worked most satisfactorily, and no slack has been required to heat the blast.

At the Cwm Celyn Works, Mr. Levick adopted the form shown in fig. 2. Two cast-iron bearers, A, were placed across the furnace, about 7 feet down, and upon these a cast-iron cone, B, was placed, the cone base being less than the diameter of the furnace. A short cylinder, C, 3½ feet deep, was suspended from the filling place, and a second cylinder, D, of about the same depth, rested on the base of the cone, the latter cylinder being larger than the other, and moveable round it, so that it could be elevated by a couple of iron bars or chains. When the lower cylinder actually rested on the cone, as shown in the figure, the top of the furnace was entirely closed in, and the space inside the two cylinders might be filled with the materials of the charge. When the lower cylinder was lifted, the charge fell with the furnace round the cone base, and the cylinder being again lowered, the top was closed in as before. By this plan, all the gases were secured and passed off by the duct, E.

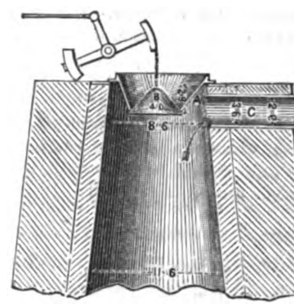
Fig. 2.



1-192d.

Another contrivance, for a like purpose, was afterwards adopted at the Ebbw Vale Works. This is represented in fig. 3. In this case, an inverted truncated cone, A, is suspended from the top of the furnace, the bottom truncated end being filled up by a second cone, B, the apex of which is passed through the bottom opening of the upper cone; whilst it is suspended from a central chain with an adjusting lever, as delineated in the figure, the lower cone is elevated to shut off the gaseous escape, so that the current can only pass through the duct, C. In charging, the materials are thrown into the upper cone, and the lower one is then let down, and the materials fall in. This plan is now in satisfactory operation at the Ebbw Vale Works. Both here and at the Cwm Celyn Works, the closed furnaces work very well, carrying as good or better burdens than the open ones; and they work with equal regularity, and make an equal amount of iron, though the area of gas duct is, in some instances, not so much as that of a 3-feet pipe, and much less than that of the small cylinders which answered so ill. Hence it is to be concluded, that the injurious effect of the cylinders could not arise from the diminished gas vent, nor yet from an obstruction of the blast; so that the only way of accounting for the evil is by assuming that the cylinders directed the materials too much towards the centre of the furnace. This is a point of great importance, as far too little attention has hitherto been given to the arrangement of the materials in the furnace.

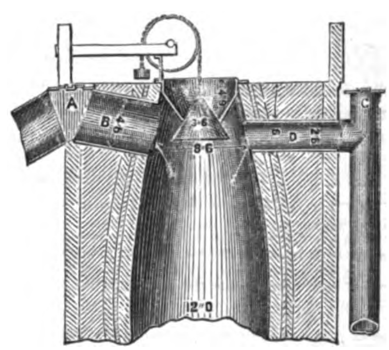
Fig. 3.



1-192d.

On the continent, the good effect of a central blast is well known, and carefully acted upon; and in the Austrian Iron-works, a great increase of production has resulted from the adoption of wide tops in the charcoal furnaces, in conjunction with a plan of filling, so that the coke or charcoal is placed in the centre, and the ore and limestone round the sides. Not long ago, Mr. Blackwell had a furnace placed under his care, already fitted with a cylinder 6 feet in diameter. In working this furnace, the usual evils of slipping and fretting tuyeres was felt, and the design of fig. 4 was therefore adopted. The furnace then worked with regularity, and carried a good burden, but only produced white iron. On lightening the burden, the metal was still white; and a further lightening showed a grey cinder, with iron still white. White iron was evidently the effect of a closed top. A 9-inch pipe was then put in at the filling place, and, after widening this pipe, a slight change took place. At this stage, it was decided that the use of the gases should be sacrificed, rather than that grey iron should not be made; and the lid, A, on the main gas duct, B, was therefore opened, together with the cover, C, on the gas duct, D, when a change was at once apparent, for the iron became grey, and regular working ensued. So obvious was the effect of the closed top in this way, that a strong wind, blowing into the open bore through which the gaseous escape was going on, would produce white iron.

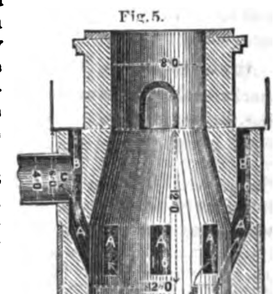
Fig. 4.



1-192d.

In Wales, where closed tops are successfully used, white iron is rather sought for; but in many cases this tendency must be a fatal objection. Were it not for this, closed tops would be universal, as lofty stacks would then be avoided, and the gases would be fully economised. The mere abstraction of the gases has nothing to do with the production of white iron, as exemplified in the Scottish furnaces, where the gases are taken off with open tops. The Dundyvan Works offer a case in point, for great attention has been paid to the question there; and it is found that the gas-economizing furnaces work quite as regularly as the others, and no difficulty occurs as to grey iron. Fig. 5 represents the Dundyvan plan. The furnace is 42 feet high, and 12 feet in diameter at the centre; narrowing begins at 12 feet from the bottom, to form the boshes and hearth, the hearth being 7 feet wide. The narrowing at the top begins at 8 feet down, the filling portion being 8 feet wide. At the bottom of this contracted part is a ring of eight flues,

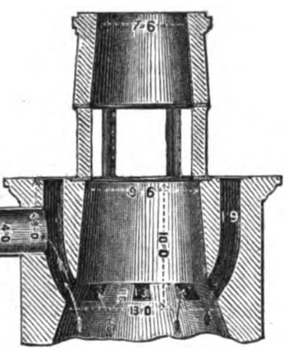
Fig. 5.



1-192d.

or gas ports, A, each 4 feet high, and 18 inches wide, and all opening into an annular flue, B, encircling the furnace, and covered in at the top by the filling plates. The gas duct, C, is set nearly at the top of this chamber. Occasionally, the entrances of the flues are covered by a wrought-iron cylinder, 10 feet wide, resting on a flange let into the lining of the furnace, at a depth of 5 or 6 feet below the filling plates, leaving a circular space between the cylinder and the lining, of about a foot in width. We have not represented this cylinder, and it is doubtful if it is really a good arrangement. In many instances of open tops, whence the gases are taken, the cylinders have been abandoned as useless; but when they are not used, it is essential that the openings into the flues should be far enough from the furnace top to prevent an admixture of air—a depth of 10, 12, and 15 feet, indeed, being often adopted.

Fig. 6.



1-192d.

Fig. 6 is the Pontypool plan without a cylinder.

In reference to this question of detail, it is necessary to inquire into the composition of the gases, and to satisfy ourselves as to the chemical changes going on in the furnace. Ebelmen's experiments show that the primary action of the blast, as it enters the furnace, is to produce carbonic acid, by the union of the oxygen of the atmosphere with the carbon of the coke. As the carbonic acid passes upwards, it is converted into carbonic oxide, by contact with the carbonic of the incandescent coke, above the zone of fusion. As the carbonic oxide ascends higher, it acts as a reducing agent upon the oxide of iron of the ore, by uniting with the oxygen, and a considerable portion is reconverted into carbonic acid. Therefore, the escape gases at the top, as well by what we have detailed, as by the carbonic acid liberated from the limestone flux, are more highly charged with carbonic acid than those taken off at a lower point; and in proportion to this, they possess less heating power, so that, when a portion only is taken off, as in open-topped furnaces, the depth of the flue is of importance. Mr. Blackwell has detailed his confirmed views as follows:—

"1st. That the waste gases may be used with great economy in raising steam, and heating the blast.

"2d. That they must be taken off in such a manner as to prevent their mixing with atmospheric air, before they arrive at the place where they have to be applied.

"3d. That this may be effected in two ways, either by placing the openings for taking them off sufficiently below the surface of the materials in the furnace, or by closing the filling part entirely.

"4th. That the first plan is the most desirable where grey iron is requisite, but where adopted it is necessary that a powerful draught should be obtained by a sufficiently lofty stack.

"5th. That when thus taken off as gas, they can be conveyed to any distance proportionable to the power of draught available without losing any of their calorific power beyond that lost by simple radiation; the whole of the calorific power to be obtained from their combustion being economised, until atmospheric air is admitted to them at the point where the heating effect is required.

"6th. That no arrangement of the filling place should be permitted which narrows that part to less than eight feet diameter; from nine to ten feet, according to circumstances, being generally the most advantageous."

This appears to be a very fair summing up of the results of our present experiences.

WORKSHOP ECONOMICS—RENSHAW'S COMPOSITE CUTTING TOOLS.

(Illustrated by Plates 115 and 116.)

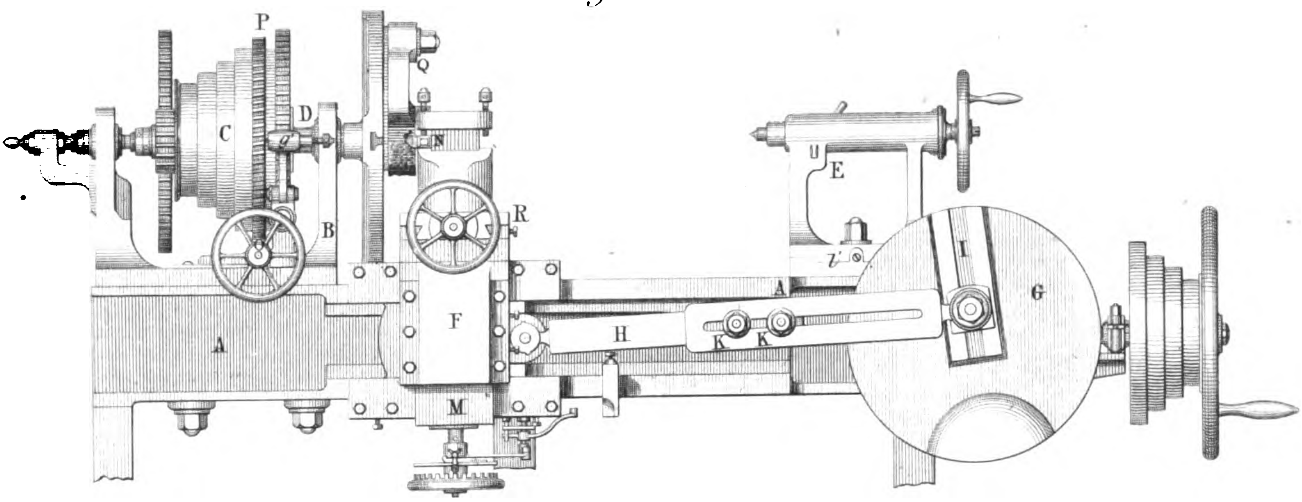
When Watt was laying the foundation of our present magnificent mechanical achievements, he was met at every turn by practical difficulties, in the want of constructive tools for working out his ideas; and many of his great conceptions were doomed, for this reason, to remain mere suggestive designs. For the same reason, numberless works, which the growth of mechanical contrivances has turned into every day operations, were treated and put down as simple impossibilities in the days when long screws were made by the crude process of wrapping a wire round a mandril, and compressing it between elastic dies. But things are now very different with us. Even our farm operations have begun to feel the benefits of machinery; and, as a necessary consequence, we now find establishments for making and repairing steam-engines and other intricate mechanism in retired country villages. This substitution of machine tools for hand labour, whilst it has introduced great accuracy of workmanship, has been the great cause of that cheapness of construction which, coupled with the application of new and better suited materials, has made us the eminent manufacturers we are.

The "finish" of machinery has also latterly met with increased attention; involving, in many respects, a judicious lightness of details and conducing to attentive management—for the attendant naturally cares more for an elegant machine or steam-engine than for one of ruder construction, and he therefore feels his pride far deeper involved in its performances.

Of the long list of machine tools now in existence, the lathe is by far the most ancient, and it is yet the most important—whether we regard it in reference to the extent and variety of its applications, or the intrinsic beauty of its action. But such a tool would be very far from meeting the requirements of the modern engineer, who has, therefore, gradually accumulated separate machines for planing, slotting, shaping, fluting, nut and wheel cutting and boring machines, with many other specially adapted tools. Each of these is limited in its powers, and is restricted to a particular class of work—so that the engineer is compelled to pass his work through many separate tools before he can complete a single piece of combined mechanism. This system of working is productive of many evils—as the loss of time in transferring and re-fixing heavy details, and the increase in the chances of error due to repeated re-adjustments. And in many branches of manufacture, more especially in light work, where good tools would be highly advantageous for occasional use, the expense of the several kinds discourages their adoption. We are, therefore, driven to look for a constructive machine of simple construction which shall in itself unite the functions and powers of the existing detached tools. Professor Willis, in his late Exhibition Lecture at the Society of Arts, has, indeed, generally alluded to this, in speaking of the want of "machines much more comprehensive, and yet simple in form, by means of which the construction of machinery in general will attain to greater perfection, and machine tools be introduced into workshops of a smaller character than at present, in the same manner as the lathe." It is precisely this that Mr. Renshaw has endeavoured to carry out in his two chief modifications of, or foundations upon, the common lathe and slotting machine.

Fig. 1, on plate 115, is a front longitudinal elevation of an ordinary back-geared lathe, to which a portion of the improvements are applied; and fig. 2 is a corresponding end elevation of the lathe, but with the following head-stock removed. In addition to its ordinary functions as a simple turning, boring, and facing lathe, this tool is here turned into a general shaping machine. Of the ordinary portions, A is the bed of the lathe, carrying the fast head-stock, B, with its cone speed pulley, C, and mandril, D; and at the opposite end of the bed is the shifting, or following head-stock, E. The shaping action is given to the slide-rest, F, by the revolution of the crank-disc, G—the adjustable connecting rod, H, of which is jointed at one end by a stud bolt in the radial slot, I, and at the other, to the end of a vertical slide-piece, fitted to a dove-tailed recess in the front of the lathe bed, this slide-piece having the slide-rest bolted to it. The length of the rod, H, is adjustable by means of a long slot and the two stud-bolts, K; and the slide-rest, besides its usual movements, has a vertical adjusting slide, M. To obtain the necessary rotatory motion for the mandril carrying the work during the action of the cutter, N, an endless screw, or worm-spindle, O, is set transversely to gear with a worm-wheel, P, on the mandril. The figures exhibit this compound tool in the act of shaping the boss of a crank, Q, whilst it is bolted to the face-chuck on which it was carried during the boring and turning actions—the shaping action being similar to that of the common shaper, or slotting machine. As the disc, G, revolves, the cutting tool, N, is traversed back and forward, so as to pare off the superfluous metal of the crank-boss, which is set concentrically with the axial line of the mandril, so that the periodical turning of the worm, O, by its projecting hand-wheel, carries round the boss as the cutting proceeds. The cutting tool is set in to its work by the top transverse slide R, fitted with a screw and hand-wheel in the usual manner; but, if necessary and convenient, both this horizontal traverse of the cutting tool and the continuous or intermittent rotatory movement of the mandril carrying the work may be made automatic by suitably connecting them with any convenient mover—as at present adopted in planing and shaping machines. When the large boss is pared down, the opposite smaller one may be similarly shaped by reversing the crank upon its face-plate; whilst the rectilinear surfaces of the crank-arm may be planed down by adjusting the surfaces to be reduced so as to agree with the periodical shifting action of the tool by the vertical slide, M. Or this right-line shaping may be similarly effected by the horizontal traverse of the tool by means of the slide R, if the tool is shaped to suit—such slide being made automatic, when advisable. The figures represent one mode in which the vertical slide, M, is made self-acting, by the traverse movement of the longitudinal slide in working an adjustable incline and a spring, on a tripping lever, with a face-wheel and click. Fig. 3 shows the application of a slotted bar for attaching the connecting-rod to the slide piece, as an easy means of adjustment, without altering the

Fig. 1.



COMPOSITE TOOLS

G. P. RENSHAW, PATENTEE,

NOTTINGHAM.

Fig. 4.

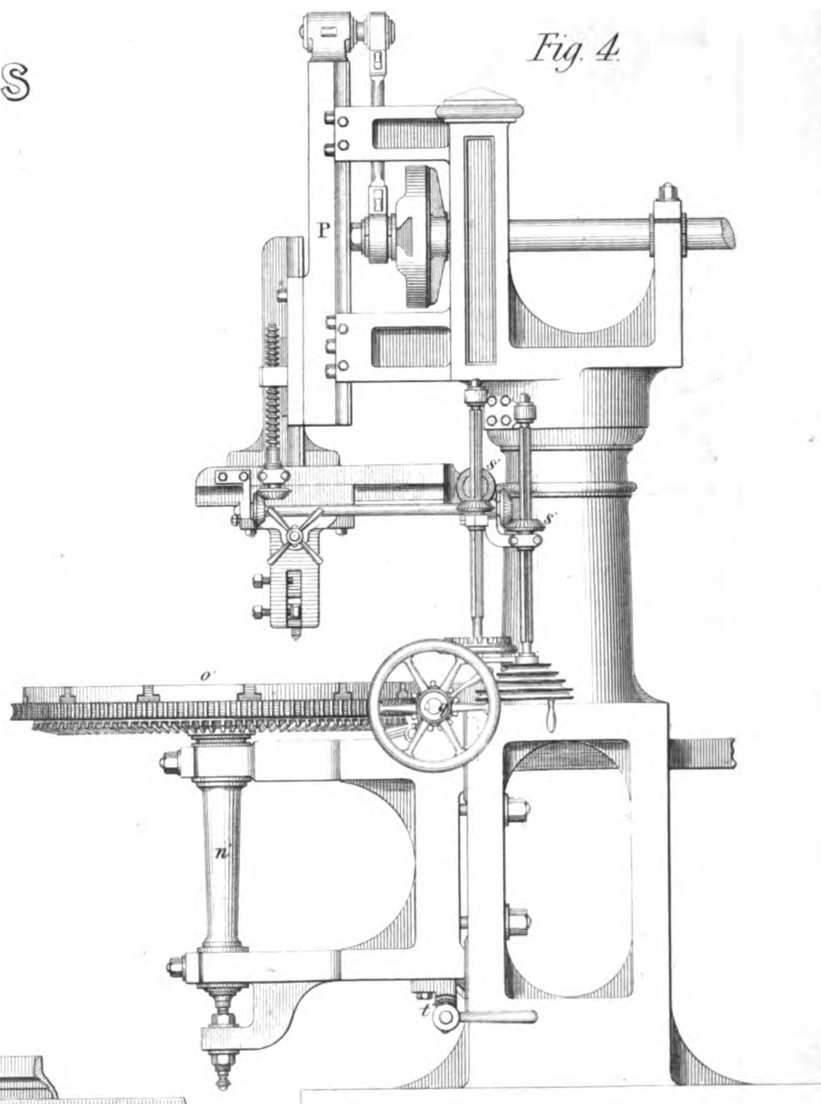


Fig. 2.

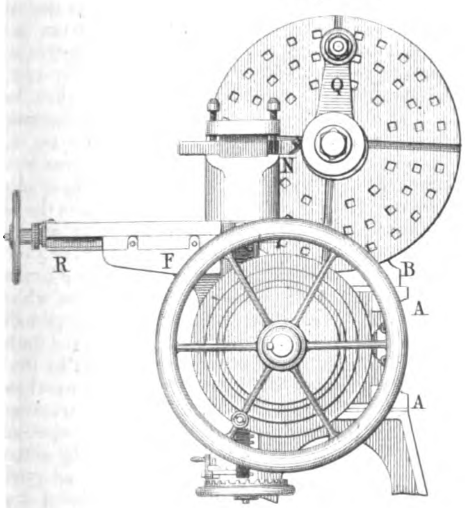
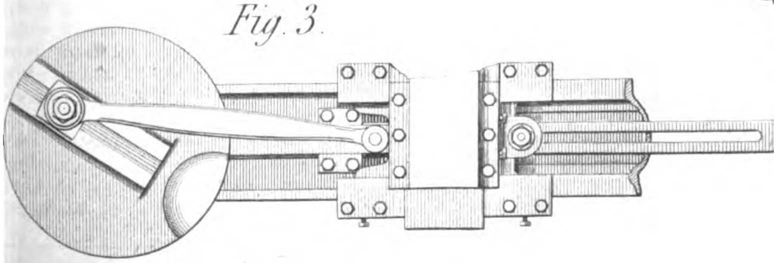


Fig. 3.



W. Johnson, Offices for Patents. 47 Lincoln's Inn Fields, & Glasgow.

Printed by Mackay & Kirkwood,

Engraved by H. Adlard.

COMPOSITE TOOLS

G. P. RENSHAW, PATENTEE

NOTTINGHAM.

Fig. 1.

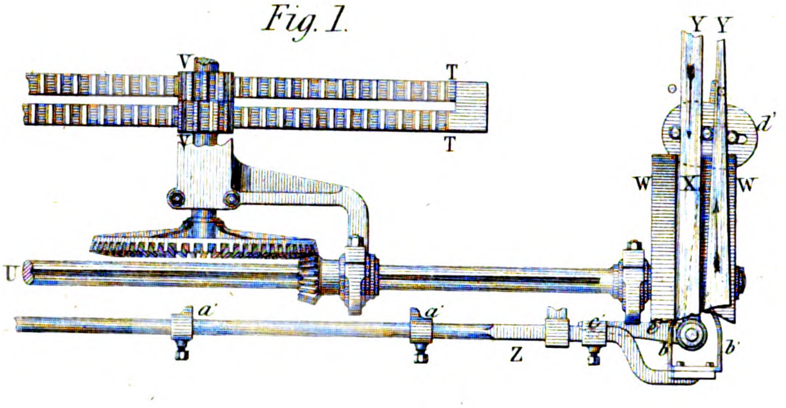


Fig. 4.

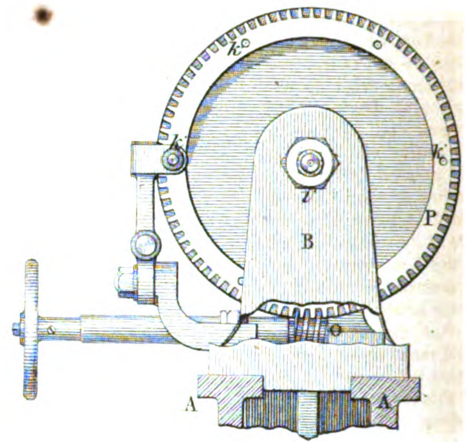


Fig. 2.

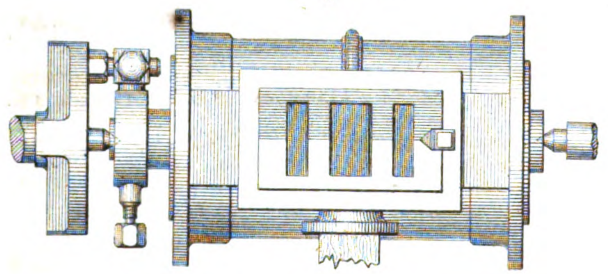


Fig. 5.

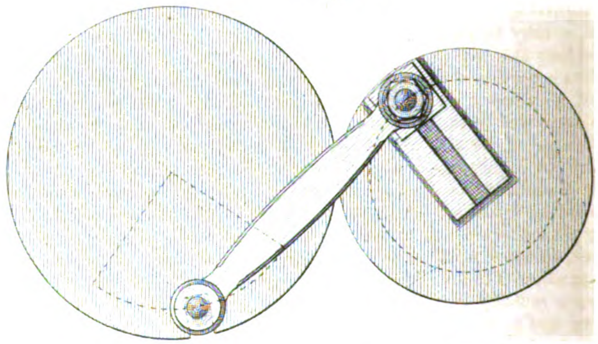


Fig. 3.

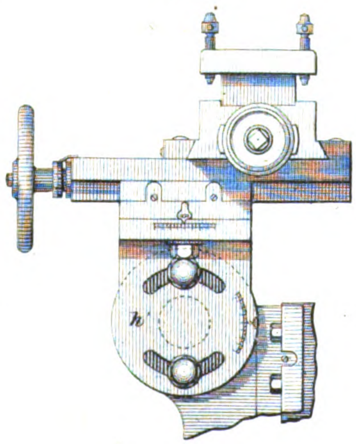
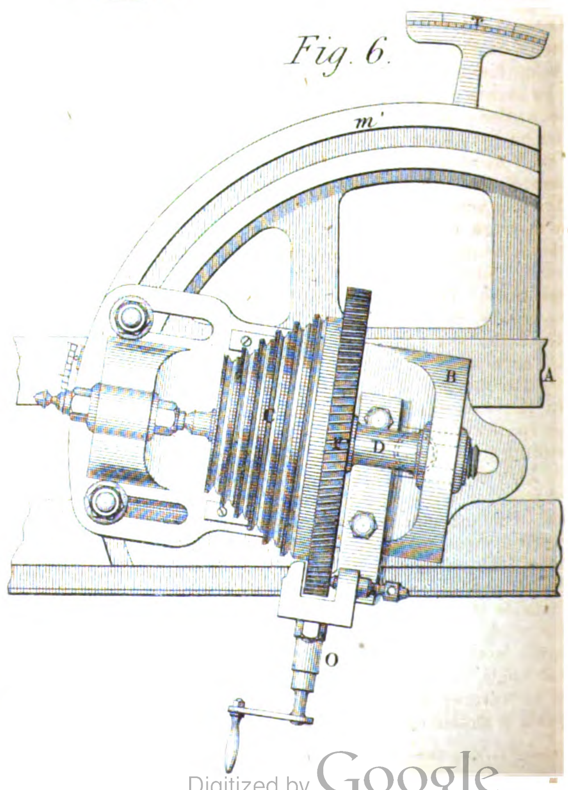


Fig. 6.



W. Johnson, Offices for Patents
47, Lincolns Inn Fields & Glasgow

Engraved by H. Adlard

connecting-rod's length. Fig. 1, on Plate 116, is a plan of a mechanical arrangement which may be used as a substitute for the slotted disc action, G, for actuating the cutting slide—the rack T, T, being fixed to the lathe-bed, whilst the pinion, V, V, travels over it—the reverse action being given by any of the modes now in use. For example, a triple pulley arrangement, with open and crossed belts, is used. Here U is the main horizontal driving shaft, carrying the three pulleys, W, X, W, on its extreme end, the two outside pulleys, W, being loose on the shaft, whilst the centre one, X, is fast. This pulley system is actuated by an open and crossed belt, Y, Y. The reversing bar, Z, has a pair of adjustable catches, a', and two springs, b', on its end, and a stop-piece, c'. The tumbling lever, d', is set on a cross stud, so that when thrown to either side of its vertical centre line, it carries one or other of the two straps on to the fast centre pulley. The tumbler has also a detent, e', for working in connection with the stop c'. The action is as follows:—one of the straps being passed upon the pulley, X, the consequent revolution of the shaft, U, causes the revolution and traverse of the pinion, V, along its fixed rack, through the bevil-wheel and pinion arrangement—the driving pinion being carried along the shaft by means of a groove and feather. By this means the longitudinal slide, which is connected to the travelling pinions, V, is carried forward into cut, until it comes in contact with one of the catches, a', thus pressing one of the springs, b', against one side of the tumbler, d', and the latter at once brings the other strap upon the fast pulley, and reverses the motion. In the return stroke of the slide, the opposite catch, a', is similarly pressed by the slide, and the tumbler is passed over to the opposite side of its centre, to bring the other strap again upon the fast pulley. During the action of the cutting tool, N, in slotting out the key-way in a wheel or other boss, as carried on the face-chuck of the lathe, fig. 1, a screw clamp, g', is adopted for fixing the mandril and face-plate in the proper position for cutting the slot, by either of the two right-line modes above described. Or, instead of the clamp, the worm, O, may be used, either in conjunction or not with a second worm, for holding the mandril in the required position. Fig. 2, on plate 116, exhibits a portion of the improvements as used in planing the slide-valve face of a cylinder, whilst the work is still in the lathe and on the supports employed in the boring and turning operations, so as to ensure the parallelism of the face with the axis of the cylinder. In this case, the mandril, or boring bar, is connected with the lathe-mandril.

Mr. Renshaw has also a contrivance which he terms a bed-chuck, intended for affixing to the lathe-bed, so as to hold various objects whilst being planed or slotted. Such chuck may be used either for parallel, or oblique, or taper work: any angle being obtainable by setting the chuck by a graduated index. Fig. 3, is an end view of a complete slide-rest, having a radially slotted disc, h', with clamping screws for setting the cutting tool to any angle; as, for example, in cutting Vs. Fig. 4, is an end view of an arrangement adopted for planing polygonal work, as a hexagonal nut, i'—the planing action being performed whilst the nut is adjusted on the lathe-mandril for facing—six equally distant divisions, k', being formed upon the worm-wheel, P, or speed pulley, C, for clamping by means of the screw g'. But, in cutting articles with numerous sides, as fine pitched flutes, it is more convenient to arrive at the required divisions by means of change-wheels in connection with the worm, O. By such means, a series of wheels on one mandril may be rapidly and accurately cut. For cutting segments, joints, brasses, and other work embracing arcs of circles, where the circular cutting action of the tool is only through a portion of the circle, a rocking motion is communicated to the lathe-mandril by the crank motion delineated in fig. 5. Knuckle or other joints may be completed in the lathe by this apparatus: being bored, turned, faced, and slotted whilst held in a suitable chuck, which, if necessary, has a radial slide for setting the work eccentrically or not. If the lathe has a geared head, this segment motion may be actuated from the shaft of such gearing—the pinion of such shaft being temporarily disconnected from the large wheel.

In the various operations of shaping, slotting, planing, fluting, or other species of cutting, either a fixed or a revolving cutter may be used, according to the peculiar nature of the work in hand. At l', fig. 1, on plate 115, the usual arrangement employed for traversing the following head-stock of lathes, in the execution of conical work, is shown, and this mode of adjustment is used, in conjunction with other apparatus, for executing taper polygons, or pyramidal figures held between the lathe centres. Or, otherwise, the fast head has an angular adjustment on the lathe-bed. Such an arrangement is delineated in the plan fig. 6, which is capable of producing cones, tapered key-ways, conical screws, and other work; and, in certain cases, as, for example, in cutting radial grooves in the face of the work, the lathe head, fig. 6, is adjusted at a great angle, or at right angles with the normal centre line, and to the line of traverse of the cutting slide—the slide-rest being thus made capable of motion across the face of the work. In such cases, the lathe-head is partly supported upon a bracket, m', and this mode may be substituted, in any case where it is desirable, for the bed-chuck previously mentioned. Fig. 4, on plate 115, is a vertical cutting or shaping machine, designed specially for heavy work, supported by the mandril only. Its general features resemble a lathe set on end, and divested of its following head. It differs from the common slotting machine in having a revolving mandril, n', as well as in the details of other portions. It is adapted alike for boring and turning, in addition to its rectilinear actions, so that when a crank, for example, is once properly adjusted upon the face-chuck o', it may remain unmoved until completed. The vertical slide, P, is worked by a slotted disc, as is usual in slotting machines—this action, as well as that of the worm, q', and wheel, r', being disengaged or set at rest during turning or boring. The same figure also shows the system of actuating the leading screws of the slides of the slide-rest, by means of the two pairs of travelling wheels, s' s', fitted to move along with the traversing slides on a pair of grooved spindles—such gearing being adjusted either by hand, or, as is preferred, by automatic machinery. The requisite angular adjustment of the mandril, n', with its corresponding framing, is also easily effected in this case, as in fig. 6, for cutting tapered key-ways and other inclined surfaces. Such an adjustment, for example, is attainable by the worm t', gearing with a worm-wheel or segment attached to the framing or fixed head of the mandril, n', and working in a vertical plane—the frame, or head, having suitable bolts and slides for shifting and clamping the table at any required angle with the horizon. It is clear that any, or all, of these several modifications, or improvements, may be applied to lathes of any description, and to ordinary slotting and shaping machines, as well as to various other constructive tools; thus enabling the machinist of moderate resources to secure most of the advantages hitherto only to be found in extensive workshops, fitted with all the modern examples of perfect, but isolated, tools.

COUTANT'S CEMENTATION FURNACE FOR RAILWAY WHEEL TYRES.

In following out the modern system of adapting specific apparatus for the performance of specific workshop operations, M. Coutant, a forge proprietor at Ivry, near Paris, has been led to design and introduce into his own works a very simple and practically valuable plan of furnace, for treating railway wheel tyres by the cementation process. M. Coutant has had long experience in metal working, and he therefore comes to his subject with all the substantial weight due to a practician who has felt his difficulties,—who has had the patience to grapple with them, and the sagacity to hit upon a means of reducing them. The annexed engravings illustrate his mode of proceeding.

Fig. 1.

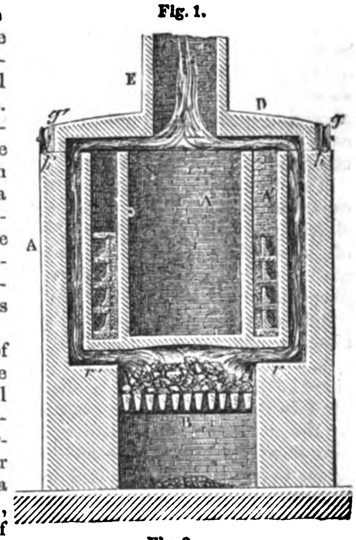


Fig. 2.

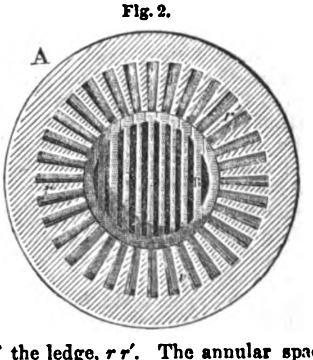


Fig. 1 is a sectional elevation of the furnace as at work, with the fire lighted beneath a pile of four wheel tyres. Fig. 2 is a horizontal section, or sectional plan of the furnace, taken just above the fire-bar level. Externally, it consists of a cylindrical shell of brickwork, A, the lower portion of which is of considerable thickness, and has within it the grate, B, for the fuel, thus forming the fire-box and ash-pit. Higher up, the internal diameter of the shell expands, the brickwork being here about two-thirds thinner than below, and this higher region is the receptacle for the tyres. The tyres are actually contained within an annular space formed by two inner concentric brick cylinders, A^1 A^2, built upon a solid flat disc of similar materials, and the whole resting on a circle of bricks, r, placed radially, and at intervals asunder, on the surface of the ledge, r r'. The annular space left between the outside of the tyre chamber and the inside of the

outer shell, forms the flue for carrying up the products of combustion from the furnace, through the interstices of the radial bricks, r, beneath. The whole apparatus is surmounted by a cover, D, a narrow space being left inside, between the cover and the top of the tyre chamber, to form a duct to carry up the flue current to the chimney, E. The cover is, of course, moveable, for the admission of the tyres. It is supported on the small running wheels, g, g', traversing upon the rails, h, h'. When a set of tyres are to be steeled by the process of cementation, they are inserted, one above the other, in their annular space, a quantity of powdered charcoal being put in along with them, but deposited in contact with the outsides only of the tyres, so that the running surface may be duly hardened without in any way affecting the original malleability of the inner tyre surface; and this restriction of the steeling is further aided by the mode of applying the heat, as the fire has no communication with the central portion of the tyre chamber, the heat being entirely confined to the annular space outside. Small grate doors are formed round the shell at different parts, to enable the attendant to ascertain the degree of heat, and the exact state of matters inside. The furnace has been some time in operation, and its results are of the most satisfactory nature.

ON THE MECHANICAL PROPERTIES OF THE GASES.

I.—SOME PRELIMINARY NOTES.

1. It may be mentioned as a property of gases—very well known, and partially understood—that, in circumstances in which they do not enter into chemical combination, they yet, when confined together, diffuse themselves over the entire space, as if each alone occupied it, and form a uniform mixture, although their specific gravities may be very different, and they may be kept externally at rest. When such a mixture has been formed, the gases never again separate spontaneously according to their different specific gravities. When two gases are separated by a porous diaphragm—as of Wedgwood ware, gypsum, caoutchouc, or animal membrane—mixture commonly still takes place: the gases, in some cases, pass through the diaphragm to the opposite sides in equal quantities; in other cases, in definite proportions; and in some few cases, only one of the gases permeates.

2. Gaseous fluids differ from other forms of ponderable matter in the amount of heat they contain. Dr. Dalton, in speculating on the phenomena of the diffusion of different gases amongst one another, as described above, regarded the atoms of ponderable matter forming their bases, as surrounded each with a sphere of caloric. An elastic fluid is, therefore, according to this view, to be regarded as a collection of spheres of heat, each having a ponderable atom as a nucleus, and each repellent of every other gaseous spherule present.

This hypothesis is very generally accepted, and it seems sufficiently capacious to cover most of the mechanical phenomena depending on the elasticity of the gases; but it affords no good explanation of the diffusion of gases—the very subject on which the author's mind was at the time most deeply engaged. It does not, however, contradict any of the phenomena of diffusion, and, in so far as it offers a very clear and simple conception of expansibility, we shall not here examine it more closely.

3. Generally, when a solid is subjected to high temperature, the cohesion of solidity is weakened; the solid expands, and if the heat be supplied in sufficient quantity, it passes to the state of a liquid, indicated by the mobility of the constituent molecules. In this state, the aggregate force which bound the molecules together in the state of solidity, seems to have been neutralized by the accession of heat. In whatever, therefore, that force—the force of cohesion—consists, it is capable of being measured by the quantity of heat necessary to overcome it. When the quantity of heat is still further increased, the molecular force appears to be entirely superseded: the matter of the solid is now so differently circumstanced, that, instead of every particle holding and being held in fixed relation to every other particle of the mass, all the particles now tend to diffuse themselves in all directions, and *seem* to repel one another without limit.

By every addition of heat, the cohesion is weakened; after a time the solid becomes a liquid, and the molecular forces—the attracting force, and the repelling force—pass to a state of equilibrium: from that instant the latter more and more predominates.

4. All ponderable matter has an affinity for heat, which differs with the kind of matter: the affinity is greater for some kinds of matter than for some other kinds.

The affinity, moreover, increases with the temperature, and therefore with the quantity of the heat-element accumulated in a given space—that is to say, with the density of the imponderable. Accordingly it may, perhaps, be found, that the intensity of the affinity can be deduced from the temperature required to effect the vaporization of a substance, and convert it into a gas.

5. Heat is regarded, according to one hypothesis, as matter; according to another, it is motion—atomic motion of the matter of the hot body. Regarded as matter, it is a highly elastic fluid—it exhibits great tendency to expand and occupy space indefinitely; regarded as motion—atomic motion—it renders free solids repellant of each other.

This is verified by some very elegant experiments on bodies heated in vacuo, which are observed to become more and more repellent as their temperatures rise. Two polished metal surfaces, so opposed to each other that their mutual influence can be observed, exhibit this repulsive action very markedly; the plates, indeed, admit of being so connected that the amount of separation can be exactly measured.

But according to the received notions of matter, the elementary atoms of which all kinds of it are composed—as well gases as solids—are nothing else than impalpably small solids, themselves unalterable, but capable of affecting each other, and of being affected like solids of sensible magnitude. We can, therefore, readily enough suppose, that in proportion as the quantity of heat accumulates about the ponderable atoms comprising the matter of a gas, these atoms will become more and more repellent of each other, and the gas will be accordingly so much the more elastic.

6. The conception of a gas best suited to minds little acquainted with chemical phenomena, is that of a system of material points, endowed each with an individual energy, which, in the same gas, is uniform for the same temperature, however far asunder those points may be. The chemist regards a gas as a combination of heat, with a ponderable base—the imponderable element predominating: it is a solution of ponderable matter in heat. The ponderable matter, in a state of atomic division, serves as the basis of the gas, and determines its specific character. The stronger the affinity is which exists between the imponderable and the material base, the more stable is the combination. When it is so great as not to be so far overcome by artificial cooling, and the application of pressure, as to reduce the ponderable material to the inelastic condition, the gas is said to be *permanent*. But when the affinity is less strong, and the material base can, by cooling under the ordinary pressure of the atmosphere, be reduced to the liquid or solid state, it is a *vapour*. Atmospheric air is an example of the first class of gases, and steam of the second. But the distinction is not rigorous; on the contrary, there is a gradual transition from those gases—as hydrogen, oxygen, and nitrogen—which have defied all efforts to condense them to those vapours—as of iron, copper, or silver—which can exist only under the very highest artificial temperatures.

7. Considered from a mechanical point of view, we may regard elasticity as the characteristic property of a gaseous fluid—that which distinguishes it essentially from a liquid; and this property is shown in the constant tendency which the gas manifests to expand without assignable limit. In virtue of this expansive tendency, a gas exercises a constant pressure upon any surface by which its volume is limited. In common with liquid fluids, it transmits an applied pressure equally in all directions; but, unlike those fluids, it yields freely to compression, occupies a proportionally smaller volume of space, and reverts to its original volume when the pressure is removed. It is connected with other forms of matter by gravity, and admits of comparison by weight. Accordingly, in a continuous body of the gas, which may be conceived to consist of horizontal strata imposed in vertical succession, the density increases with the depth; it is greatest in the lowest stratum, and least in the highest. This is exemplified by the observed conditions of equilibrium in the atmosphere. But in such quantities as the fluid is confined and operated upon mechanically, the weight is usually inconsiderable in comparison with the pressure which it exerts in consequence of its inherent tendency to dilate. Practically, therefore, the pressure on the retaining surface from within outwards, is uniform over the whole area, and perpendicular to it at every point. Accordingly when the envelope is throughout equably expansible, it assumes a spherical form in obedience to the eccentric pressure by which it is distended; but when, on the contrary, the envelope does not yield to the internal pressure, the reaction on the unit of area is found experimentally everywhere sensibly the same.

II.—DEFINITION OF THE PRESSURE REFERRED TO A UNIT OF SURFACE.

8. The constant pressure which the fluid exerts on the interior of the vessel that contains it, when referred to some unit of surface, actually assigned, or tacitly assumed or implied, is indifferently termed the *elasticity* and the *tension* of the gas. In a primary sense, the former of these terms simply expresses the property from which the pressure is derived; and the latter, the degree in which that property is manifested. In the derivative sense, they are used synonymously; and they are sometimes

convenient when it is requisite to distinguish between the expansive tendency of the gas, and the pressure which it balances under any particular circumstances. The explicative expressions, *elastic force* and *expansive force*, are likewise used as distinctive equivalents.

The measure of the pressure on the unit of surface is the weight by which a plane area = 1, would be maintained in contact with the fluid, supposing it to fill an equal aperture in the containing vessel. Let this pressure be denoted by p; and let it also be presumed that an orifice of some definite area $= a$ units, is fitted with a valve for which the weight necessary and sufficient to keep it in contact with the fluid, when applied perpendicularly to the centre of gravity of the orifice, is P; under these conditions, the equilibrium of the fluid will remain undisturbed, and the surface of the valve will sustain a pressure equal to that exerted on any other equal area of the retaining surface, and there will obviously exist the relations—

$$\frac{P}{a} = p, \quad P = ap, \quad \frac{P}{p} = a.$$

It is the value of p assigned in weight that we definitively term *the pressure referred to the unit of surface*, briefly *the pressure;* and by metonymy, the *elasticity*, sometimes the *tension*—of which it is strictly only the measure.

The unit of surface commonly adopted, and which we shall uniformly employ, is the square inch; and that of the pressure p is the lb. The value of p is indeed very frequently expressed in terms of a column of mercury, sometimes of water, and occasionally it is measured by a column of the fluid itself, but always with a tacit reference to the equivalent pressure in weight.

III.—RELATION OF THE DENSITY AND ELASTICITY OF A GAS.

9. Regarding a gas as a system of material points, endowed each with an individual energy which is constant in the same gas for the same temperature, it follows that the aggregate reaction exercised upon a given unit of the surface opposed to the expansion of the gas, will be directly as the number of the individual pressures acting upon it. In the same gas, the sum of the atomic pressures acting on the given unit of surface, is obviously as the number of points contained in the unit of volume; it is therefore directly as the density. Hence, should the density be made to vary through successive conditions without any change of the temperature, the elasticity of the gas, measured by the pressure it sustains on the unit of surface, will pass through simultaneous changes of intensity in the same order and degree; and we shall always have the ratio of the densities $\frac{D_1}{D_2}$ = the ratio of the contemporaneous pressures $\frac{P_1}{P_2}$.

10. It likewise follows, from this conception of the mechanical constitution of a gas, that the volume which a given weight of it occupies will vary in the inverse ratio of the pressure which it sustains on the unit of surface. For, the elasticity being represented by the pressure, it follows that the density is doubled by doubling the pressure; and to double the density is necessarily to reduce the volume to a half. The ratio of the elasticities corresponding to any contemporaneous volume, will therefore constitute the analogy—

$$\frac{P_1}{P_2} = \frac{V_2}{V_1}; \text{ or } \frac{P_1.V_1}{P_2.V_2} = 1;$$

which is the famous proposition known as Boyle's law, and sometimes improperly attributed to M. Ed. Mariotte, who reproduced Boyle's experiments "On the Spring and Weight of Air" to the French Academy, eight years after they had been published in England, and about two years after a Latin translation of the original tract had been published on the continent. It might indeed be shown, by internal evidence of Mariotte's memoir, that he did not even take the trouble to repeat the experiments throughout, but rested satisfied with the facts supplied by the English philosopher. The method of experimenting, including the apparatus employed, is, moreover, in every way so similar, as effectually to preclude the possibility of believing the coincidences accidental. There is, however, no need to argue it as a question of priority—the claim of our countryman is at length pretty extensively recognized, and more so even in France than in England. So be it.

11. Boyle's law forms the basis of all calculations relative to the mechanical action of the gases. It expresses the constant relation in which the tension of the gas varies as the density is made to vary—*without any change of temperature.* And, conversely, when the measure of the tension is known, it enables us to determine the density, in terms of the unit of its own kind, and therefore also the volume occupied by a given weight of the fluid.

Otherwise: if the contemporaneous pressure exerted on the unit of the containing surface, when the contained fluid is made to pass through successive degrees of density, are represented numerically by units of their respective kinds, the law assumes that the ratio of those numbers is uniformly constant for the same temperature. Also, assuming the mass of the fluid to remain constant, the density will necessarily and obviously increase in exactly the same ratio as the space in which the fluid is enclosed is diminished, and decrease in the same ratio as the space which it occupies is augmented.

All this, however, expresses nothing more than is contained in the analogy stated above, which may be put in this other form:—

$$P_1 V_1 = P_2 V_2; \qquad (1)$$

which shows that the magnitude of the volume multiplied into the number representing the contemporaneous pressure is a constant product. And, again, since the density is directly as the pressure—as was shown above—we shall also have—

$$D_1 V_1 = D_2 V_2; \qquad (2)$$

which shows that the density into the volume is likewise constant.

From these relations it is always easy to find one of the terms when the others are known. Thus, from equation (1) we have—

(I.) $V_2 = V_1.\frac{P_1}{P_2}$, in which V_2 is what V_1 becomes when the pressure to which the gas is subjected changes from P_1 to P_2 on the unit of surface. And—

(II.) $P_2 = P_1.\frac{V_1}{V_2}$, in which P_2 is what P must become, that the volume may change from V_1 to V_2 without change of temperature.

It is not necessary to write the equations for the density from equation (2), as they may obviously be found by simply writing D for P in (I.) and (II.) deduced from equation (1).

12. Finally, then, by way of fixing the signification of these expressions, it will be proper to exemplify their applications by a few practical instances. But before we proceed so far, let us once more repeat, for the benefit of those who are little in the habit of dealing with general symbols, that, according to the law we are endeavouring to propound, when the density of a given quantity (by weight) of any elastic fluid is doubled by compression into half its original volume, its expansive force is likewise doubled; and, conversely, by allowing it to expand to double the volume which it primarily occupied, its expansive force is reduced to half that which it originally exerted on the same area of the containing surface, provided always that the temperature remains unchanged. These relations are true, and might be repeated for any other definite degrees of compression and expansion. Let us endeavour to make the expression general. It is simply this, that when the fluid is compressed into $\frac{1}{n}$th of its primitive volume, its density and its tension or pressure are simultaneously increased to n-times the density and tension or pressure it originally possessed. Conversely, when expanded to n-times the primitive volume or bulk, the density and tension are reduced to $\frac{1}{n}$th of what they previously were. And taking n generally to denote any number, whole or fractional, these conditions include each other, except that when n is passing through the value $n = 1$, the significations of the terms *compression* and *expansion* are then being reversed.

These expositions of the general proposition ought, in connection with a few illustrative examples, to suffice to thoroughly fix it on most minds of ordinary aptitude.

(*a.*) At the temperature of 62° Fahr., it is found that 1 lb. of common air occupies a volume of 13·02 cubic feet under the ordinary atmospheric pressure of 14·7 lbs. on the square inch: let it be required to determine the volume under a pressure of 70 lbs. on the same unit of area.

$$\text{Here } \left.\begin{aligned} P_1 &= 14\cdot 7 \\ P_2 &= 70\cdot 0 \\ V_1 &= 13\cdot 02 \end{aligned}\right\} \begin{array}{l}\text{and therefore,} \\ \text{by equation (I.)}\end{array} \quad \begin{aligned} V_2 &= 13\cdot 02 \times \frac{14\cdot 7}{70} \\ &= 2\cdot 7342 \text{ cub. ft.}\end{aligned}$$

That is to say, the temperature remaining at 62° Fahr., the quantity of 1 lb. of air, under a pressure of 70 lbs. per square inch, would occupy a volume of 2·73 cubic feet.

(*b.*) Suppose it inquired, What is the weight of a cubic foot of air under a pressure of 20 lbs. on the unit of area? By proceeding as in the last example, we find that 1 lb. of air at 62° Fahr., under a pressure of 20 lbs. per square inch, occupies a volume of 9·5697 cubic feet; consequently, a volume of it equal to a cubic foot will weigh ($\frac{10000}{95697} = 0\cdot 0104497$) lb.

(*c.*) It is found, by means of the barometer guages attached to the air cylinder of a blowing-engine, that the air enters under a pressure of 14·2 lbs. on the square inch, and is discharged under a pressure of 17 lbs.: what portion of the stroke does the piston travel over before the eduction valve opens?

If L = the length of the stroke of the piston, and c = the clearance, then will L + c be proportional to the volume of air in the cylinder at the beginning of the stroke, and may be assumed to be represented by V_1 of our formula. Also, let l represent the portion of the stroke described at the instant the valve opens: then will $(L + c) - l$ represent the length of the portion of the cylinder which the air at that instant occupies, and which may be represented by V_2. We have also $P_1 = 14{\cdot}2$ and $P_2 = 17$; and therefore, by making these substitutions in equation (I.), we arrive at the relation—

$$(L + c) - l = (L + c)\,\frac{14{\cdot}2}{17}; \text{ whence } l = \frac{28}{170}\,(L + c);$$

which, by putting $c = \frac{1}{15}$ of L, becomes $l = \frac{L}{5{\cdot}69}$. And supposing that the length of stroke L = 10 feet, then $l = 1{\cdot}7551$ ft. = 1 ft. 9 inches very nearly: that is to say, the eduction of the air from the cylinder begins when the piston has passed over 1 foot 9 inches of its stroke.

13. Although the tension is commonly expressed in terms of the unit of weight, it is often, and indeed very often, it is more convenient to estimate it in terms of the height of the mercurial column it is capable of balancing. It is, however, easy to perceive that this mode of representing or measuring the pressure renders no change of our formulas necessary; for if H_1 and H_2 represent such barometrical heights as that the columns of fluid shall exercise, by their weights upon the unit of base, pressures equal to those denoted by P_1 and P_2, then those symbols may manifestly be substituted in the equations, instead of their equivalents of actual weight. We shall then have—

$$V_2 = V_1 . \frac{H_1}{H_2}; \qquad H_2 = H_1 . \frac{V_1}{V_2}.$$

And, moreover, in these expressions, the measure of the compressing force may obviously be taken in inches of mercury, feet of water, &c.—whichever is the most convenient in the particular case. Let us take a single example in further illustration.

Let us suppose that the manometer, measuring the intensity of a fan-blast, indicates a pressure of 7 inches of water at a time when the barometer shows the pressure of the external air to be 28½ inches of mercury.

The weight of water is to that of mercury as 1 to 13·58, at the temperature of 60° Fahr.; therefore, the pressure of a column of water = 7 inches in height, is equivalent to a column of mercury of $\frac{7}{13{\cdot}58}$ inches high; and this, added to 28½ inches, the value of H_1, gives the whole pressure measuring the intensity of the blast = $(28{\cdot}5 + {\cdot}516)$ inches of mercury = H_2. Hence, if we take the density of the external air = 1, the density of the blast will be—

$$\frac{H_2}{H_1} = \frac{28{\cdot}5 + {\cdot}516}{28{\cdot}5} = 1{\cdot}019.$$

The volume into which a cubic foot of the external air is compressed by the fan, will therefore be $\frac{1}{1{\cdot}019} = 0{\cdot}9684$ cubic feet,—presuming always that the temperature remains unchanged, and which, however, it does not, as we shall hereafter have occasion to show very fully.

The pressure on the square inch of area may be found by multiplying the weight of a cubic inch of water by the height of the guage-column. The weight of the cubic inch of water = 0·036 lb., and therefore the pressure of the blast was $(0{\cdot}036 \times 7 = 0{\cdot}252)$ lb. on the square inch, above the pressure of the external atmosphere.

This was the strength of blast produced by a fan of 4 feet diameter, with 5 radial vanes of 12 inches breadth, by 11½ inches in length, and making 754 revolutions per minute.

We pause here until another month shall afford us a further lease of space.

β.

RENOU AND GUÉRIN'S TARE-COMPENSATOR BALANCE.

The familiar transaction of the purchase of a jug of molasses in a retail shop furnishes a homely, but pointed, illustration of the use of this elegant little contrivance. According to the ordinary system, as conducted with the common weighing machine, the dealer first of all weighs the empty vessel, or, in other terms, brings the beam into equilibrium with the vessel in one scale-pane, and then adds the intended weight of the article being purchased to this equilibrating weight, in the other. This round-about mode of correction for the tare is greatly improved upon by Messrs. Renou & Guérin, by the introduction of a compensator in the balance itself.

Fig. 1.

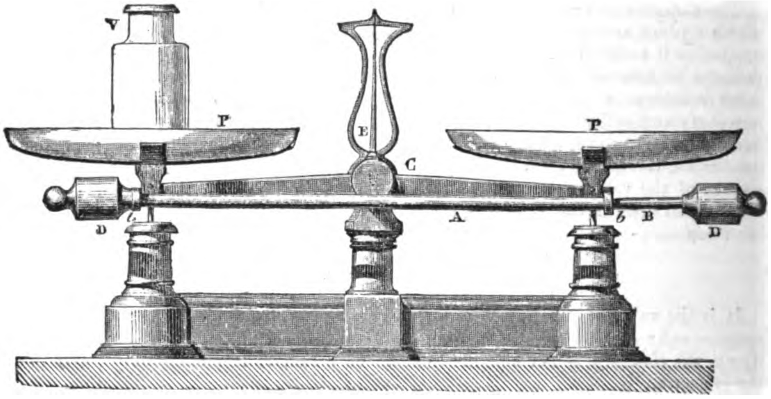


Fig. 1, of our engravings, represents a side-elevation of the new balance in the act of weighing a jar; and fig. 2, is a partially sectioned detail of the compensator detached. A tube, A, is fixed alongside the main balance-beam, C, by means of the brackets, b b, and a metal rod, B, is fitted to slide in and out of the tube at pleasure. The end of this rod carries a weight, D′, a counterweight, D, being attached to the other end of the tube; the weight of the two being so adjusted as to maintain the balance in equilibrio, when the moveable one, D′, is run up to the bracket, b. The rod is maintained at any given extension by means of a small frictional spring within the tube.

Fig. 2.

The action is obvious: the empty vessel, V, is placed on one of the scale-pans, P′, and the compensator, D′, at the opposite side, is drawn out until the index, E, shows a restored equilibrium. The article to be weighed is then put into the vessel, and the weights necessary to balance it in the scale-pan, P, will represent its exact nett weight, without requiring any calculation or reduction for tare.

The contrivance is susceptible of various modifications. Thus, both the weights, D, D′, may be attached to the rod, the one sliding in as the other is drawn out. Again, the rod may have a screw thread upon it, working in nuts at the ends of the tube, an arrangement capable of very minute adjustment; or, the tube may be altogether dispensed with, the rod simply passing through nuts in the brackets, b b.

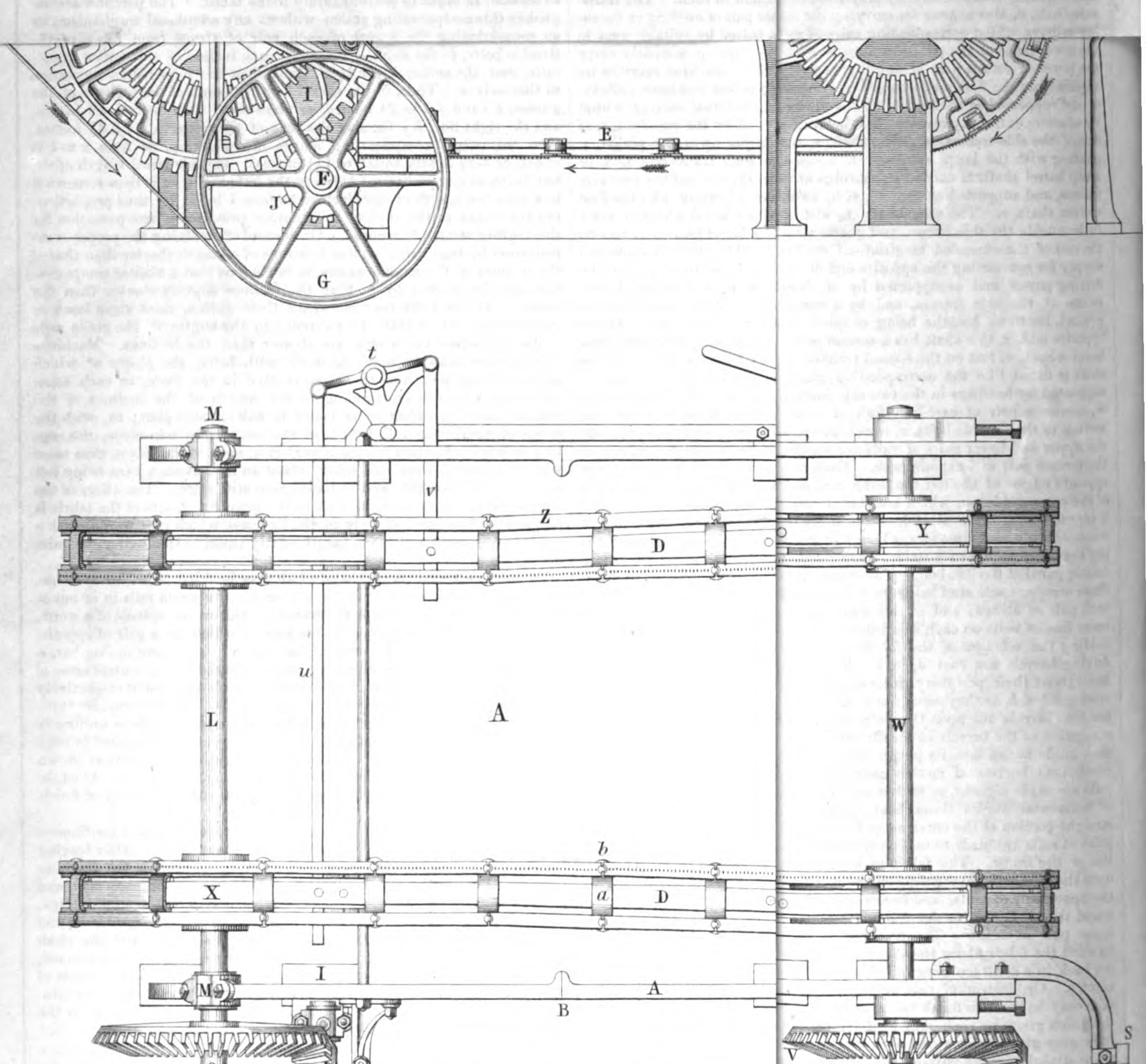
The salesman who adopts this contrivance will not only run less risk of cheating himself, or making mistakes, but will also be prevented from cheating his customers. It is an improvement of particular value to the druggist, in whose practice a life may be, and often is, lost by a mistaken weight.

PATERSON'S MUSLIN FINISHING MACHINE.

(*Illustrated by Plate* 117.)

Custom or prejudice has enacted that, before a piece of muslin, or other ladies' dress fabric, shall be deemed fit for use, it must receive what is known by the manufacturer as the "elastic finish." This is a process intimately connected with the stretching and drying of the goods, which, if simply dried after the plain starching process, would be hard and unyielding, with the interstices of the threads filled up with the starching matter, having somewhat the effect of hair-cloth. To get rid of this objection, it was formerly the practice, and is even yet with some classes of goods, to employ girls to "thumb" the piece, one operative standing on each side of the fabric, the two working in concert, and, with a peculiar fingering action, angling or drawing the warp and weft threads diagonally over each other, so as to elasticate the piece, by breaking up the starchy bonds between the threads. This appears a simple affair, and yet we will venture to affirm that few, very few, textile processes have latterly given more employment to inventive minds, or involved the construction of more machinery, than the production of the "elastic finish." One of the latest and most elegant of these contrivances is that patented by Mr. T. L. Paterson of Glasgow, whose machine we have illustrated in our plate 117.

Fig. 1 on plate 117, is a longitudinal elevation of Mr. Paterson's machine, as now working at the Jordan Bank Works, Partick, near Glasgow. Fig. 2 is a corresponding plan, showing a short piece of muslin as in the act of being finished. The total length of the working machine is


I
E
F
J
G
t
M
v
Z
D
Y
A
L
u
W
b
X
a
D
I
M
A
B
O
P
V
S
T
U
K
F
G
N
H
12
W. Johnson, Offices for Patents
47 Lincoln's Inn Fields, & Glasgow.
Engd by G. Aikman

44 feet, but six of the arches of the standards are broken away, leaving only the two end portions, so as to avoid useless repetition, and compress the figures within reasonable limits.

The framing of the machine consists of two long side standards, A, bolted together longitudinally by flanges at B, whilst the two sides are held together transversely by stay-rods, C, bolted to each. The transverse rods, C, also answer for carrying the upper pair of angling or finishing rails, D, whilst corresponding pairs of rods, bolted by suitable eyes to the lower parts of the pillars or standards of the framing, similarly carry the lower or return pair of angling rails, E. The machine receives its motion from the first motion-shaft, F, carrying the fast and loose pulleys, G, and supported at the end, H, by a wall or other external bearing, whilst its opposite extremity revolves in a bearing carried by the standard, I, of one of the side-frames, A. The shaft, F, has keyed upon it a pinion, J, gearing with the large spur-wheel, K, on the long transverse link or strap barrel shaft, L, carried in bearings at M, in the ends of the two side frames, and supported at the end, N, by an external bearing, like the first motion shaft, F. The same shaft, L, also carries a bevel wheel, O, set a little outside the side frame, and gearing with a bevel pinion, P, fast on the end of the extended longitudinal shaft, Q. This shaft is employed simply for connecting the opposite end of the machine directly with the driving power, and is supported by six bearings, R, in brackets, bolted to one of the side frames, and by a standard, S, at one end, from the ground, its three lengths being coupled in the usual manner. At the opposite end, T, this shaft has a second bevel pinion, U, gearing with the bevel-wheel, V, fast on the second transverse link barrel shaft, W. This shaft is fitted like the corresponding shaft, L, already described, and is supported by bearings in the two side frames. Each of the shafts, L and W, carries a pair of cast-iron link or strap barrels, X and Y, for giving motion to the flexible belts, Z, which carry the fabric to be finished. As the upper and lower pairs of rails are similar in form, the description of the former pair will explain both. Each rail, D, is of the T section, the opposite edges of the flat top being rounded to fit to the concave edges of the cross guides, *a*, which are placed over the flat top, so as to "clip" it on each side. The flexible belts, Z, are formed of thin flat pieces of composition metal, two straps being placed side by side in each, extending between each cross guide throughout the series, so as to form a double parallel flexible belt. The cross guides carry the joint-pins, *b*, for these straps, each stud being passed through the two junction ends of each pair of straps; and in this way two endless belts are formed, the inner line of belts on each side being made to carry the stenter points for holding the selvages of the fabric in the act of being finished. The driving-barrels are cast open in the sides; and at uniform intervals throughout their periphery, recesses, *d*, are cast in them to receive the cross guides, *b*, as they come round in course of working. In this manner the barrels act upon the belts like ordinary pitch-chain gear, the revolution of the barrels in the direction indicated by the arrows causing each guide to fall into its proper recess, thus giving the pair of belts a continuous horizontal motion over the angular rails, D and E. These rails are made zig-zag, or with a continuous uniform series or succession of horizontal angles throughout their length, with the exception of a straight portion at the entering or feeding end, A. At this end, the two pairs of rails are made to incline or taper towards the longitudinal centre line of the frame. The fabric to be finished is hooked by its selvages upon the pins or stenter points on the inner line of the belts, Z, running on the upper pair of rails, and becomes gradually stretched, after passing round the barrels, X, to the full width between the stenter points of the lower pair of belts. The traverse of the endless belts then draws forward the fabric along the upper pair of angling rails, the belts returning back in a contrary direction along the lower pair, as indicated by the arrows. Or, instead of this arrangement, the upper and lower pairs of rails may be made to finish two separate pieces of cloth, and, if necessary, the finish given by each may be different. As, for instance, the upper rails may give the angled elastic finish, whilst the lower rails, being made straight for the purpose, may give the common stiff finish. As the belts are continuously traversed along their angular rails, the action of the guides gives the belts a continuous series of horizontal angular movements, corresponding to the angles of the rails. As both lines of the double chains or belts are thus simultaneously angled, it follows that the warp of the fabric stretched by its selvages between the two inner chains is angled in a precisely similar manner, as represented by the short piece of cloth, *e*, on the upper length of belts. In this way the longitudinal warp threads are continuously angled throughout the traverse of the fabric, whilst the transverse weft-threads, being unacted on laterally, are retained constantly at right angles to the longitudinal centre line of the machine, or to the true longitudinal centre line of the piece, from which line the apices of the angles project equally on each side. By this arrangement, the warp threads are caused to move or work freely over the weft threads, and produce what is technically known as the "elastic finish," without the use of transverse rods passing across the piece. As this angling or finishing movement necessarily tends to take up or stretch the fabric, it is essential that some compensating arrangement should be introduced to allow for such angular stretch or lateral extension, in order to prevent injury to the fabric. The patentee accomplishes this compensating action without any additional mechanism, by so proportioning the length of each pair of straps from *f* to *g*, of the flexible belts, to the angular length of each incline of the angled guide-rails, that the action of the belts shall effect the required compensation in themselves. Thus, if the actual length of each of the inclines of the guides, *h i* and *i j*, be 24 inches, or the sum of both inclines 48 inches, and the right line, *h j*, forming the base of the triangle, *h i j*, 47 inches, then the proper compensating length of each strap, as from *k* to *l*, is equal, or very nearly equal, to $11\frac{5}{8}$ inches. The combined length of the two belts, as comprehended between the letters *k*, *l*, *m*, is then somewhat less than the length of each incline, as from *h* to *i*. By thus proportioning the straps to the angles, an accurate principle of compensation for the angling stretch is secured. Or, instead of obtaining the proper compensation by thus using a strap or straps of a length shorter than that of the inclines of the angled guides, it is obvious that a similar compensation may be secured by making the inclines slightly shorter than the straps. As the belts traverse along their guides, each strap loses or gains slightly in its path, in reference to the angles of the guide rails —that is, when the straps are shorter than the inclines. Machines of this class may be made to work with belts, the pieces of which are double the length of those represented in the plate, or each separate strap nearly corresponding to the length of the inclines of the angles. But an objection is found to exist in this plan; as, with the straps of nearly the full length of the inclines in one piece, the angling or finishing action is very imperfect at each of the joints, thus more widely separated from each other, about an inch at each joint being left unbroken or unangled, and in its original stiff state. The effect of the double strap is clearly delineated in the plan, fig. 2, where the fabric is represented as angled slightly in the line, *n o*, which part would, with a straight unjointed strap of a length nearly equal to the incline, be quite unangled.

In order that various widths of cloth may be finished in this machine, an arrangement is added to it for traversing the guide rails in or out at pleasure. This is worked by the handle, *p*, fast on the spindle of a worm, in gear with a worm-wheel, *q*, in the arms of which are a pair of opposite studs, *r*, from which links proceed fore and aft to the long sliding-bar, *s*. The two opposite ends of this long bar are jointed to the central arms of bell-cranks or double levers, *t*, the arms of which are jointed respectively to transverse rods, *u v*, hinged to the guide rails. In this way, by turning the single lever, *p*, the space between the guide rails is uniformly widened or narrowed, as the links, *u v*, are respectively attached in each case to opposite guide rails. This machine, constructed exactly as shown in our plate, has been in effective operation at the works of Mr. Aked, in Partick, for a considerable time, producing a very good quality of finish at an economical rate.

The pieces to be operated upon are stitched together into a continuous length, prior to being passed into the starching apparatus. After leaving the starching mangle, this stream of cloth proceeds direct to the finishing machine, through the hands of two girls, who sit, one on each side, and in front of the strap-barrels, and place the selvages on the stenter pins. Then, as the goods pass over the part A, the widening commences, and the cloth is stretched well out until it enters the angles, and the cloth passes into the drying stove. When all the angles have been traversed, the fabric is delivered at the opposite end of the machine to the hands of the folder, by Holliday's folding machine. The process employs altogether seven hands—stitching, starching, finishing, and folding, at the rate of fifty pieces, of twenty-five yards each, per hour.

GLEANINGS FROM THE SOCIETY OF ARTS EXHIBITION.

As a supplementary notice to our last month's report of this collection, we now append illustrative particulars of several noticeable contributions, which either did not find a place in the report in question, or were but meagrely discussed. Amongst the latter we must reckon Mr. Simons' (of Dale-end, Birmingham) series of lamps for mining uses. Fig. 1 represents his form of miners' common safety lamp, contrived for fixing or hanging in any part of the mine where danger from any sudden evolution of gas is to be apprehended, but where the work is still progressing, as it affords a good steady light, equal to that of six candles. It is locked up, and a piece of talc is suspended from the top of the gauze, to prevent burning through, as well as in front of the glass, to protect it from the heat. This lamp burns six or eight hours without any attention.

Fig. 2 is a "miner's candle socket," with lock-spring principle attached, and fitted with a spear and hook, to enable the miner to stick or hang it where it is wanted. Fig. 3 is a "miner's safety candle socket," fitted up like the preceding one, but having a gauze shade on the top of its nozzle, to enable it to be carried about safely without extinguishing even in strong currents, and to prevent explosion. Fig. 4 is a "miner's perfect safety lamp," having a ring at the top with a non-conductor, to prevent heating, and a side handle, so that it may be either hung up or carried easily about. It is locked up, and has a self-acting extinguisher. Mr. Simons has also two varieties of lamps, with revolving shades or reflectors, for the gate roads in mines. With these lamps the light may be thrown right on any spot required, whilst the shifting shade protects it from the wind. He has a good arrangement of a Cornish miner's skull-cap lamp, for carrying on the head, or on the front of the wheel-barrow, when going up the adits, and reversing when returning.

Fig. 1.

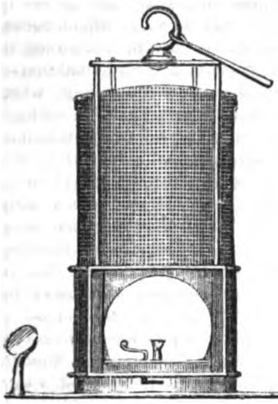


Fig. 2.

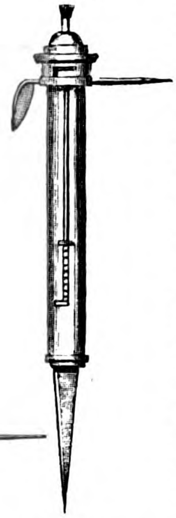


Fig. 3.

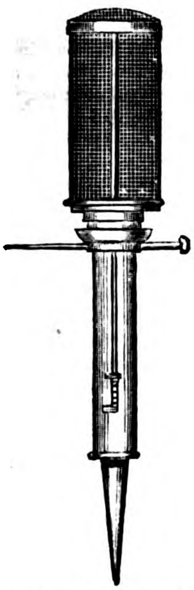


Fig. 4.

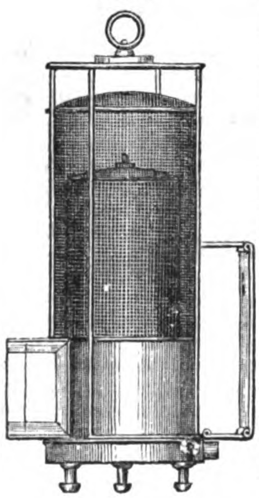


Fig. 5 of our illustrations represent a cleverly-arranged "dispatch box, and travelling writing desk," by Messrs. J. W. and T. Allen, of West Strand. The cut affords its own explanation. Within a space of fourteen inches by ten, and six inches deep, are contained all the requisites for the writing desk, as best suited for the wants of the traveller. It is a most creditable production.

Mr. Goss, of Manchester, has a newly-arranged theodolite, the principal improvement being the arrangement of the centres, by means of which, the adjustments of the levels, and of the line of collimation, are dependent on the inner centre alone. The division plate works on an independent centre—so that it answers for levelling and taking vertical angles, even with the plate removed. The instrument is considerably strengthened by casting the centre and the uprights, carrying the horizontal axis, in one piece; as also the cradle holding the telescope and the axis. The vertical arch is set outside the uprights; and whilst the weight is thus reduced, the reading is simplified.

Messrs. W. Muir & Co., of the Britannia Works, Manchester, have a set of beautifully-designed copying and embossing presses, which are evidence of the very excellent workmanship of the firm. The presses illustrate the lever, screw, and "fly-press" applications—the latter having india-rubber springs for elevating the die after the stroke.

The "fruit-dressing machine," by Mr. Shaw of Lewes, is a very effective apparatus. It is carried on a low rectangular frame, and the wire sifter has a peculiar combined back, and forward, and rocking motion given to it, by a single crank driven by a winch handle and wheel, and pinion gear. The sifter is set horizontally; and the connecting-rod being carried to one end of it, it not only receives a direct back and forward motion, but it has a central rising movement, so that half the fruit constantly falls to each end. It will either dress fruit or sift sugar.

Fig. 5.

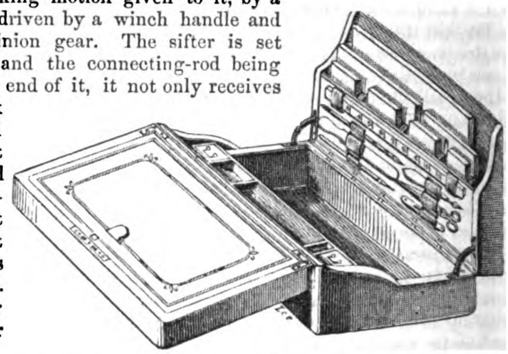
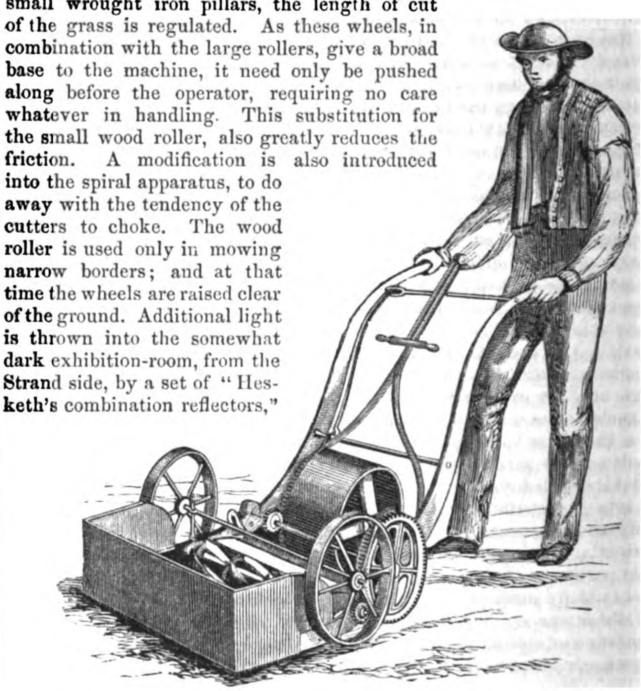


Fig. 6 represents a "lawn mowing machine," by Mr. Samuelson, of the Britannia Works, Banbury—a very prominent object in the central portion of the room. It is an improvement on what is well known as "Budding's lawn mower"—having wheels attached directly over the cutters, by the adjustment of which, upon the small wrought iron pillars, the length of cut of the grass is regulated. As these wheels, in combination with the large rollers, give a broad base to the machine, it need only be pushed along before the operator, requiring no care whatever in handling. This substitution for the small wood roller, also greatly reduces the friction. A modification is also introduced into the spiral apparatus, to do away with the tendency of the cutters to choke. The wood roller is used only in mowing narrow borders; and at that time the wheels are raised clear of the ground. Additional light is thrown into the somewhat dark exhibition-room, from the Strand side, by a set of "Hesketh's combination reflectors," made by Messrs. Boyd & Chapman. The arrangement is simply that of a series of narrow silvered glass strips, capable of facile adjustment to the desired angle, to light every part of the room, whilst they do not project inconveniently on the outside of the window. We must return to this exhibition for yet a few more gleanings.

Fig. 6.



ON A NEW FORM OF SCREW-PROPELLER.

In making use of the pages of the *Practical Mechanic's Journal* for the introduction of a novel plan of screw-propeller, I shall venture on a few general notes, which appear to be rendered necessary, from the fact, that the propeller in question is designed for the development of certain properties, valuable only on the assumption that the involved views will meet with the approval of the practical man, these views being, indeed, somewhat at variance with those generally entertained. The action of the screw, as a propeller, is exceedingly complex, and is by no means easily comprehended. This, in some degree, arises from its being greatly affected by variations in the state of the water, in the direction of the wind, in the immersion and frictional resistance of the ship, as well as in other concurring conditions.

Very many experiments have been tried—numberless observations have been taken—ships have been built, and vast sums have been expended—all with a view to arrive at correct principles, on which to determine the different proportions entering into the formation of a perfect screw steamer:—the shape of the hull—the proper position for the propeller, and the elements of its form and construction—the proportion of engine power to stroke, and that of many minor details,—all these problems have exercised the highest engineering talent of the age; but I think it may be safely said, that though much has been done, and many data have been collected, they yet remain unsolved. The results of the repeated trials that have been made are all so variable and uncertain, that they defy classification according to any known law, and screw steamers continue to be built of proportions so various, that the idea is suggested of their having been designed at random, or, to say the least, as mere experiments.

The operation of a screw propeller may be described * in various terms. It may be supposed to act like a common screw in a solid nut, on the principle of the inclined plane, an allowance being made for the yielding or slip of the water; or it may be supposed to give the water an impulse backwards, in the same manner as the float of a paddle-wheel. The action may be investigated differently, according as one or other of the above principles is made the starting-point; but though the route is different, the conclusions arrived at with most sets of data are so similar, that it is not very material which description, or starting-point, is adopted. I, however, prefer the latter, for it seems to lead to a simpler explanation of some of the phenomena attendant on the employment of the screw as a propeller.

Amongst other phenomena to which I refer, is that which has been termed, "negative slip;" in other words, the occurrence of a greater speed of ship than would take place were the screw working in a solid nut—that is, than the number of revolutions in a given time, multiplied into the pitch. This has been explained as taking place in consequence of the ship's drawing after her a body of water, in which the screw acts, the effect being similar to what would be produced with a screw working in a solid nut, if the nut traversed in the same direction as the screw. Here, however, we have an extraordinary paradox: the propeller-screw is actually supposed to draw along the *nut*, or body of water, in which it acts, and by the reaction of which it produces the onward motion of the ship! This explanation has been supported by the following illustrative argument. When a current passes through the arches of a bridge, a body of water will continue stationary behind each pier: a screw might be caused to work in this dead water, and some thrust would always be produced by it, though its speed, considered as working in a solid nut, were very far short of that of the current. It is argued that the case of a screw steamer is a parallel to this. I do not think so. Let us suppose the water to be motionless, and assume the absence of friction—could a screw placed behind the pier, as stated, *produce* a current, having a greater speed than itself?

It is an undoubted fact, that a sailing vessel does draw a considerable volume of water in her wake, but it is necessary to consider how the motion of the vessel is produced. A sailing vessel is acted on by the external force of the wind, and produces a current in the water, just as an oar-blade would, if drawn through it by the hand. The water closes in behind the vessel so rapidly, especially when the run is full, that it receives an impetus in the direction of the ship's motion; and with each increment of the vessel's progress, the water that is immediately behind more easily closes in after the ship, from being already disturbed. On the other hand, the motion of a screw steamer is produced by the screw's driving the water in a contrary direction. There is no necessity for the water to close in behind the vessel, or rather, behind the screw; the screw, on the contrary, accumulates the water there, drawing it, as it were, from around the ship's bottom in advance of itself (that is, of the screw), and if there is any motion at all in the water behind the vessel, it must be in a contrary direction to the vessel's motion—it must be a recession. A paddle steamer, however, may draw a small volume of water after her; for, though her motion is produced, as in a screw steamer, by driving the water backwards, yet the water, acted on by the paddles, is a little on each side, and not, as with a screw, directly in the centre of the ship's wake. In other words, the vessel's onward motion is produced by a power acting somewhat externally to the actual water in which she moves, and the paddles do not obviate the necessity of the water's closing in behind her; but, of course, the current so produced is not in a position to give rise to the appearance of negative slip with the paddles, and it is, moreover, quite overpowered by the receding side-currents produced by them.

The usual explanation of negative slip, which we have here examined, is, to say the least of it, unsatisfactory. In place, however, of urging further arguments against it, and since it has gained much ground from being the only explanation † as yet attempted, and would not be easily rejected were not another offered, we will suggest that this phenomenon may be referred to peculiarity in the screw, which may be conceived to be of such proportions, as to draw through itself a greater volume of water than is equivalent to the quantity displaced by the ship, when going at the rate of the screw's pitch per revolution; that is, without any slip, positive or negative. This would tend to produce an accumulation at the stern, did not the ship go faster, and so give rise to the existence of negative slip. This view may be illustrated by a reference to Mr. Siemens' elegant rotatory water-meter.‡ If the vanes were enlarged laterally, so as to occupy a space of double the transverse area, their pitch remaining the same, the water would go the same *distance*, during one revolution, as with the meter's actual proportions, but in *double* the quantity. According to this, the difference occasioned by differently proportioned screws should be very great; but in the case of the ship, there are many things that will tend to lessen it—and chiefly the actual, though not the apparent slip, which will be greater; that is, when the screw is considered as drawing through it a cylinder of water of a diameter equal to itself, rather than as screwing through a solid nut. It will at once be urged against this explanation, that though a less quantity of water would actually go through a screw of smaller diameter, yet, other things being equal, and if there were no slip, an advance would be made through as great a body of water. For instance, two cylinders of wood, of identical dimensions, may be imagined, having screws of different diameters, but equal pitch, working through their centres. Both screws would advance through the same quantity or extent of wood during an equal number of revolutions. This illustrative argument may be opposed by another. Let us take two pipes, of the longitudinal section shown in the figure; that is, increasing in the middle to, say, double the transverse area. In the enlarged part of each, let a screw be placed. Make one screw of the diameter of the enlarged part, the other of the diameter of the smaller parts of the pipe, and let them revolve, the pipes being full of water. Assuming that there is no slip, the larger screw will make the water flow through the narrower part of the pipe twice as fast as the smaller screw, or at double the rate of the pitch per revolution. A parallel case may be imagined with a ship. She may be considered as moving in a pipe, of somewhat larger bore than her midship section. In the case of the pipes, the effective bore was supposed to be lessened in advance of the screw, whereas the ship herself reduces or obstructs the effective bore in her case. Of course, if these imaginary screws worked each in a solid body of water—for instance, at a considerable depth, and without the ship to obstruct the access of the water to the larger, as compared with the smaller one—then the advance would be equal in both cases, as with the screws in the cylinders of wood.

I supposed the ship to move in a pipe. This is not the actual case, and the water would be drawn in from beyond the limits of the supposed pipe, and thereby correct the effects of the obstruction. This renders the question one of the balance of resistances. A case can be very easily imagined, in which the resistance to the vessel's increase of speed would be less than that of the water in rushing in from the sides. In other words, we should fix the limits of the supposed pipe at a point from beyond which it would require more power to draw in the water, than to overcome the resistance to greater speed. According as, in consequence of this point being further from the ship, the supposed pipe would be larger, so would the ship form a less proportionate obstruction, and the negative slip with one be less as compared with another screw.

I have merely attempted to explain a peculiar phenomenon, and do not wish to be understood as in any way advocating the production of negative slip. Experiments and observations have convincingly shown, that it is an expensive way of producing progressive motion. Nor, from what has been said, is any argument deducible against the use of screws of large diameter. The defect should be corrected by amending other proportions, rather than the diameter of the screw, for there is no doubt that the best results are to be obtained from screws of large diameter.

* Knowledge, as existing in the mind, may be defined as the power of understanding and *describing* what is presented to the perception of the senses. Printed knowledge is but *description*. Thus, the planets were formerly described as revolving round the earth, and in epicycles. This was a correct description of appearances as far as it went, but in later days it has been discovered that it did not describe all, and so a more perfect description has been adopted.

† Since this was written, an attempted explanation has been given by Mr. R. Bodmer, and will be found in our "Correspondence" for this month.—Ed. P. M. Journal.

‡ *Practical Mechanic's Journal*, Vol. V., page 178.

If anything is at all deducible from past experience in screw propulsion, it is the necessity of a capability of accommodation in the screw, if maximum results are to be obtained under varying circumstances.

In fluids, motion takes place in the direction of least resistance. A paddle-steamer may be said to advance, because in doing so she meets with less forward-resistance, than the back-resistance to the paddles; that is, resistance to their motion through the water in a contrary direction. With a paddle steamer, an increase in the forward-resistance reduces the velocity of the paddle-wheels, because the back-resistance is very great, and the engines cannot overcome the two resistances combined. In the screw, however, since the acting surface is not at right angles to the plane of its motion, as in the paddle-wheel, the back-resistance is not so great. Consequently, when the forward-resistance increases, more power finds a vent, as it were, in driving the blades through the water, the proportion between the back and forward resistances being changed. The speed of the vessel, as compared with the power exerted, is always inversely as the forward-resistance is to the sum of both.

In a paddle steamer, the velocity of the engines will diminish almost directly as the forward-resistance increases, since the back-resistance is very great, as compared with it; whereas, with a screw, the velocity of the engines will only diminish in the ratio of the increase of the forward-resistance to the back and forward resistances combined. This smallness of the back-resistance of the screw, is what occasions such a waste of power when the forward-resistance increases. It may be remedied by increasing the back-resistance, either by enlarging the acting surface, or by setting it more nearly at right angles to the plane of its motion. The latter method is, however, objectionable, because the propelling action takes a less forward direction in proportion as the angle of the blade is brought nearer a right angle; and though the speed of the engines would be brought up, yet the speed of the vessel would be less than if part of the power were allowed to go to waste.

The best plan is to increase the acting surface, and at the same time cause the impelling power to act with a greater leverage, by reducing the pitch. If the pitch be reduced in proportion as the acting surface is increased, the back-resistance will remain the same—and this will be equivalent to a reduction of the forward-resistance, as compared with the back-resistance; for, supposing the pitch be reduced to one-half, only one-half the forward-resistance will be met with during each revolution, whereas as much back-resistance will be met with as before.

Having thus shown that an increase of the forward-resistance calls for a modification of the screw, I will proceed to consider the effects of a decrease in this resistance. Such decrease may be caused by the utilization of wind-power. And here we have a state of matters, in which the action of the screw is capable of being made very superior to that of the paddle. If a paddle steamer can steam eight knots per hour, including slip, or sail eight knots when using either power separately, she cannot increase her speed by employing both. With the screw, however, it is different. In experiments with the *Archimedes*, it was found, that though she could only steam eight knots, exclusive of slip, or sail nine knots, yet, with both steam and canvas, she attained a speed of 11½ knots! the screw exhibiting on the occasion a negative slip of half a knot. I am of opinion, that had the pitch of the screw then been altered, so as to cause the negative slip to disappear, or even become slightly positive, a greater speed would have been obtained, even with less speed of the engines. If a propeller-screw worked in water as in a solid nut, the only limit to the increase of pitch would be the strength of the blade and the friction; but as it is, according as the pitch is coarser, the action becomes more like that of a centrifugal fan. When, however, the ship is driven through the water partly by her canvas, the pitch of the screw may be made coarser with advantage.

A screw-blade gives an impulse to the water in a direction at right angles to the acting surface. This can never be parallel with the ship's course, and it may be considered as compounded of two impulses—one parallel with the ship's course, the other at right angles to it. Such impulses may be represented by the dimensions of a parallelogram, of which the diagonal represents the compound impulse.* The best results will be produced by a screw of such a configuration, that the axial and lateral impulses bear some particular proportion. If, however, the axial impulse is increased by the wind, such proportion between the two will be destroyed: but it may be restored by increasing the pitch; for, according as the pitch is greater, so is the lateral as compared with the axial impulse. Without some lateral impulse, no propelling effect would be produced. A simple disc, set on the shaft at right angles, would be the realization of a screw producing no lateral effect, or with the pitch reduced to nothing, but no propelling effect could be obtained from it. Now, if a ship be driven by wind at such a rate, that the water would of itself flow through the screw at exactly the rate that the screw could drive it without slip, and in the absence of wind—the pitch would be practically reduced to nothing, and the screw would produce no more (additional) effect, than a disc would on still water; and the pitch must consequently be increased, in order to give the required proportion of lateral impulse. There are means of modifying the paddle, with a similar object, but they are attended with much greater mechanical difficulties than in the screw.

What I have endeavoured to show is, that, supposing the best proportions of screw are ascertained for the ordinary or standard circumstances of a smooth sea and no wind, these proportions require to be different, either when the forward-resistance is increased, on account of head winds, of the drag of a vessel in tow, or of greater immersion of the ship herself—or, on the other hand, when the forward-resistance is diminished, and the ship is assisted by favourable winds.

The advantages to be obtained from a screw, of adjustable proportions, have not been wholly unperceived by those whose attention has been given to the subject of screw-propulsion; and, accordingly, several mechanical expedients have been proposed for obtaining the required capability of adjustment.

Another desideratum connected with the screw propeller, more particularly when employed in vessels of war, or only as an auxiliary, is, some simple means of obviating its becoming an impediment when steam-power is not used.

I will hastily glance over the attempts that have been made to attain the objects specified above.

Shorter (1800), Trevithick (1815), Millington (1816), Carpenter (1840), and Wimshurst (1850), proposed screws to be worked by shafts, having universal joints; consequently, enabling the screw to be lifted out of the water, so as not to impede the ship when sailing. Taylor (1838), Beadon (1845), Hays (1845), Montgomery (1846), as well as others, who did not obtain patents, proposed to lift the screw out of the water, through an opening or well in the ship, immediately above, the screw requiring to be disconnected from the shaft. Amongst these, Hays also added descending door-plates, on each side of the dead wood, to cover up the space otherwise occupied by the screw, or to cover the screw itself, the blades being turned, so as to lie within them. Wimshurst (1840), and Galloway (1843), endeavoured to attain the same end by simply drawing the screw off the end of the shaft, and then hauling it over the ship's side. Woodcroft (1844), Hays (1844), Hays (1845), Wimshurst (1850), Woodcroft (1851), and Beadon (1851), have patented contrivances for varying the angle of the blades. In some of these plans, hollow shafts are employed, in others rods and bell-crank levers, to actuate the blade-turning mechanism from the interior of the vessel; but they are all liable to frequent derangement, and give a very clumsy outward configuration to the propeller. They are, however, efforts in the right direction, though the benefit due to the principles on which they are constructed is nullified by mechanical defects. Oxley (1845) makes his screw-blades with sliding-pieces, actuated by rack-gear, in such a manner as to expand or contract the acting-surface. It would doubtless be well to have the power of doing this at times, but the plan has the defects of those last mentioned in a more eminent degree. Seaward (1846), Maudslay (1846), and Tucker (1850), place their screws behind the rudder, the shaft passing out at one side of the stern-post. Henwood (1847) has also his screw behind the rudder, but the shaft passes through the centre of the stern-post, the rudder being so formed and placed as to be entirely below it. Seaward, Maudslay, and Henwood, lift the screw out of the water, by means of a "tongs"-shaped frame, rising through an opening in the ship immediately above. Tucker lifts his screw by means of a lever, fixed on the end of a rocking-shaft, which passes into the interior of the ship; the free end of the lever embraces the boss of the screw, and by turning the rocking-shaft, the screw, after being disconnected from its own shaft, is brought up, and made fast to the quarter. Montgomery (1846) also proposed to lift the screw by means of a lever, very similar to Tucker's.

Buchanan (1846) was the first to employ the self-acting principle. He connected the blade loosely to the shaft by a spindle, the acting surface being all on one side of this spindle, so that the resistance of the water acting on it turned the blade, until it was stopped by a shoulder on the boss; or caused it to lie in a plane parallel with the keel, when the engines were not working. Maudslay patented the same thing (in 1848), with the addition of teeth on the necks of the blades, those of one blade gearing with those of the other, making them turn simultaneously, the blades not being directly opposite on the shaft. Macintosh (1847) and Heindryckx (1850) patented screws of a more ambitious nature. Those of Buchanan and Maudslay would not vary in pitch—their blades

* See "Remarks on some Properties of the Screw Propeller," *Practical Mechanic's Journal*, Vol. V., page 125.

would either lie in a line with the keel, or assume one particular angle; whereas Macintosh's and Heindryckx' would assume an angle determined by the proportion of lateral to axial resistance. They were flexible and elastic, and, if their tension be properly adjusted, should always assume the angle of most effect. Macintosh's, in particular, was a very elegant propeller. The four plans last mentioned had, however, one great defect; namely, the necessity of mechanism similar to that employed by Woodcroft, Hays, and others, to set the blades in a position enabling them to produce backward motion. It will be manifest, on a little consideration, that if the after-part of the screw be flexible, and the fore-part rigid, a forward motion will ensue, whichever way the shaft revolves. If it revolves in one direction, a right-handed screw will be formed; and a left-handed one, if it revolves in the other. In order, therefore, to change the direction of the ship's motion, it will be necessary so to modify the propeller, that the fore-part of the blade becomes flexible, and the after-part rigid.

Griffiths (1849) patented a series of innovations of doubtful benefit, though showing some ingenuity. According to his invention, the blades are made to swivel, and a spring is applied to them, which is intended to make them assume a greater pitch when the velocity increases from any cause. I have not heard if this self-acting adjustment has been found to answer in practice. If the axis on which the blades swivel exactly bisects their acting surface, the difference of resistance met by the fore and after part of the blade will surely be much too small to turn the blade, for both Maudslay and Buchanan found that a considerable overhang produced but little turning effect. Mr. Griffiths, however, proposes to give a greater surface to one side of the blade, if necessary; and he presumes that the action will be as follows:—When the vessel is assisted by wind, the screw will revolve faster, and will, consequently, meet with greater resistance, which, acting on the overhanging and leading side of the blade, turns it so as to assume a greater pitch. It seems to me, on the contrary, that, under such circumstances, if the speed of the screw be not adequately increased, the water will act on the back of the blade, or at least be so relaxed in resisting power as to permit the spring to force round the blade in the contrary direction to that intended, thus making it finer in pitch. Or, if the screw proportionately increases in speed, the resistance met by the blades will remain as before, and they will, consequently, maintain the same pitch. If the vessel meets with greater resistance from head-winds, or other causes, Mr. Griffiths' screw would assume a greater pitch. This would certainly pull up the engines, but a much lower speed of vessel would ensue. When the vessel is impeded, we want a fine pitch; and a coarse one, when she is assisted. Again, according to Mr. Griffiths' system, one-third of the diameter of the propeller is occupied by a spherical boss, the professed object of which is to avoid the centrifugal action of that part. I am of opinion, that the centrifugal action of the central part of the screw is much exaggerated. Indeed, many of the expedients proposed for obviating it remind one of that human infirmity, which, straining at a gnat, swallows a camel. Let us take a screw, for example, which has been found to advance through the water at the rate of the pitch, per revolution, minus ten per cent. slip, such advance being supposed to be caused entirely by the outer portion of the blades. If the screw advances through the water, the water must flow through the central part at the specified rate, even when there are no blades there. Now, since the blades only go ten per cent. faster, the central part could only have that per-centage of effect in any direction. The angle of a true helix increases towards the centre, but that is counterbalanced by the decrease in the velocity. Indeed, supposing the screw worked without slip, the water flowing through the central part would actually impinge on the back of the blades, and be thereby impeded, if the angle did not increase. Granting that all the propelling effect is due to the outer portion of the blades, it is necessary to consider how these are to be attached to the shaft. If arms are substituted for the screw-shaped central part, they will necessarily be thicker, and, consequently, oppose a greater impediment to the flow of the water. In fact, the best disposition of the quantity of metal necessary to support the outer part of the blades is in the form of a screw; and if it is intended that the central part should not act on the water at all, the whole screw must be made with the pitch expanding from the centre to the circumference.* As to employing a spherical boss, I think it is actually injurious; for, not only will it be a greater impediment to the flow of the water, but the forward part of it will give the water an outward direction, thus aiding the centrifugal action. It would be far better to make the boss cylindrical, terminating in a cone behind the screw, and coinciding in front with a cylindrical swelling, formed in the dead wood, and merging into the body of the ship. Such an arrangement would obviate any difficulty of access or exit of the water to or from the central part, caused by the closeness of the dead-wood, without substituting a greater impediment. Another of Mr. Griffiths' innovations consists in reducing the width of the blades towards their outer extremities, or rather, increasing it towards the centre. This may be done with a flat blade, in order to make up for the diminishing velocity; but an increasing obliquity, as in the ordinary screw-shaped blade, is certainly a much better expedient.

* As suggested by Mr. Atherton, and tried in the *Minx*.

Malo (1850) sets a pair of blades on a hollow shaft, and a pair on another shaft, passing through the centre of the first. These blades are very narrow, and, by making one shaft turn on the other, they are brought in a line within the dead wood. When operating, one pair is turned round, so as to be at right angles to the other, thus forming a four-bladed screw. And last in the list, Carpenter (1851) proposes a method of unshipping the blades separately, and hauling them on deck.

Amongst all the plans enumerated, I cannot select one which is preferable to the use of a well-proportioned, ordinary, invariable screw. This is not because the object sought is not desirable, but because the means employed are such as counteract any gain derivable from the embodiment of the principles on which they are severally designed. Indeed, it has been my endeavour to show, that much is to be gained by making the screw capable of accommodating itself to circumstances, and it is scarcely necessary to add, that the propeller about to be described is designed to possess such a property; that is, first, the blades are to lie altogether in a plane, parallel with the keel, when the shaft does not revolve. Second, When the shaft revolves, the propeller is to assume the form of a true screw, varying in pitch and extent of surface according to circumstances. In other words, when the ship utilises the wind power, the pitch is to become greater; and when the ship meets with greater forward-resistance, caused by head-winds, greater immersion, or by towing another vessel, the pitch is to become finer, and the acting surface to increase in extent, so as to take a firmer hold of the water. And, thirdly, the propeller is to be entirely self-acting.

I will, next mouth, endeavour to show how these conditions are to be fulfilled.

EDMUND HUNT.

MECHANIC'S LIBRARY.

Agricultural Chemistry, Elements of, 6th edition, 6s. 6d. Johnson.
Builder's Price-Book, 1853, 12mo, 4s., cloth. Laxton.
Civil Engineer and Architect, vol. XV., 4to, 25s., cloth.
Electro-Magnetism, Therapeutic, 8vo, 5s., cloth. Froriep.
Irrigation, Italian, 2 vols., 8vo, plates, 24s., cloth. R. B. Smith.
Natural Principles of Beauty, royal 8vo, 5s., sewed. D. R. Hay.
Natural Philosophy, Elements of, 2s. 6d. Shoedler & Medlock.
Photography, Manual of, "Encyc. Met.," 3rd edition, 6s., cloth. R. Hunt.
Sanitary Improvements, Lecture on, 8vo, 1s. sewed. Johnson.
Screw-Propellers, On, 8vo, 21s., cloth. J. W. Nystrom.
Science, Readings in, 5th edition, revised, foolscap 8vo, 3s. 6d., cloth.
Water, Treatise on, 12mo, 2s., cloth. J. Glynn.
Writing, Origin of, illuminated, imp. 8vo, 21s., cloth. Noel Humphreys.

RECENT PATENTS.

MANUFACTURE OF CASKS.

GEORGE DUNCAN AND ARTHUR HUTTON, *London.—Enrolled July* 27, 1852.

The series of improvements here specified comprehends five separate heads, embodying many very ingenious mechanical contrivances for the manufacture of finished casks from the crude wood staves, or blanks. These are: an apparatus for giving form to the jointing edges of the blanks, the producing jointing edges on the parts forming the cask-heads, drilling the holes for the dowells in the heads, shaping the periphery of the wood blanks for the heads, and the putting together the details of the casks, and the arranging and working the cutters for hollowing and bevelling the staves and grooving the heads.

The stave-blanks, in their original flat rectangular condition, are fed in upon a sloping table, where they are each caught by a "dog"-link hanging from an endless chain, which is slowly traversed forward, and thus conveys the blanks in a continuous stream into and along a curved guide-trough. This trough is a segment of a circle, with its concave side uppermost. A rotatory cutter is set on each side of the central and lowest portion of the trough—the spindles of the two being inclined towards each other at their lower ends. Hence, as the stave enters the curved trough, its front or entering end is necessarily directed by this trough-guide between the lower portions of the inclined cutters, which are closest together, and thus the deepest edge-cut is given, to make the stave narrowest at that point. Then, as the stave proceeds onward, the curved form of the guide gradually elevates the front end of the stave, so that, when half through, the stave is exactly horizontal, and is

raised up towards the wider space between the cutters, thus giving it less cut. The further traverse of the stave causes the after-end to nick in precisely the same manner, so as to be tapered off as before. This gives the intended "gore" to the stave; whilst the angle of the cutters serves, also, to give the bevel to the joint-edges. The patentees also apply the same principle in using a very large polygonal drum, or skeleton pulley, over which the blanks are carried by an endless chain. By this contrivance, as the distance from the pulley's centre to the longitudinal centre of each side of the polygon is less than from the centre to the apex, or junction angle, of any two neighbouring sides, it follows that the stave is carried up the higher at its two ends than at its centre, and the two side cutters being suitably arranged, the edges are gored or tapered off each way, as in the former example. The blanks for the heads are fed into a machine by a dog-chain, in a similar way, and pass along hard up against a guide, through which works a rotatory cutter for giving the jointing-edges. Each blank is held down flat by a bearing-pulley and hand-lever, and is kept up to the cutter by an arrangement of spring-pulleys. The dowel holes are drilled in these pieces by two opposite sets of four revolving drills, worked by a single drum overhead, and two belts. The two sets of drills have their points opposed to each other, and the blank being laid in on a table between them, the eight drills are traversed into contiguity by a right and left screw spindle—all the drills entering and drilling the wood at once. When one side only is to be drilled, the drills on that side work into a drilled blank inserted for the purpose.

When a set of head blanks are mounted together to form a head, they are clamped between two vertical revolving discs on two horizontal shafts, set in the same axial line, and a system of india-rubber contact surfaces is used for retaining the pieces securely, even if they vary in thickness. On one side, a rotatory cutter rounds off the periphery of the head; whilst on the other is a duplex bevelling cutter, for bevelling off the edge on each side. The mounted blanks of course revolve slowly between the cutters, and an eccentric motion is attached for the purpose of giving a slightly oval form to the head, so as to compensate for the after shrinking of the pieces across their width. Each of the cutter shafts is carried in a pair of oscillating lever arms ingeniously connected with the vertical slide of the eccentric, so that the cutters are simultaneously traversed by means of two links, and made to coincide in their movements, and approach to and recede from the head twice during each revolution of the latter.

In building the cask, the shaped staves are arranged round an expanding disc, one by one, and held thereon by two straps hung over a drum, and weighted so as to nip and hold the staves as they are successively laid in, whilst the disc is slowly turned round. A metal band is then bolted round them. On the same shaft are two loose hollow metal cones, and these are traversed up towards each other by right and left screw spindles, one cone being on each side the holding disc, so that as the cones come up they enclose and compress the ring of stave-ends to the cask shape. In this state the ends are bevelled and grooved for the heads by two sets of revolving cutters, which are now set in motion, on the main shaft. The hollowing and grooving cutters are of the ordinary kind; and when these operations are accomplished, the cutters are removed, and the central holding disc is now drawn out of the cask, by reducing its diameter. This reducing movement is effected by means of six radial traversing arms working in volute grooves, like Messrs. Elce's universal lathe-chuck. The holding cones are then slackened, to enter the heads, and compression is again applied when the heads are in, and the casks are finally hooped and finished.

EXHAUSTING SIPHONS.

Jas. A. Heathcote, *Lieut. Indian Navy, London.*

This invention is No. 681 of the *Provisional Protections*, under the new law, 1852. It consists in the fitting to the ascending leg of the siphon a valve of light action—as a hollow ball, for example,—for the purpose of obtaining a ready means of filling the pipe with the fluid to be drawn off. The chief application contemplated by Lieut. Heathcote is in a long flexible pipe for use in cases of fires on board ship, occurring, as they do in the majority of cases, below the water-line. The lower end of the pipe, to which the valve is fitted, is weighted by the insertion of lead beneath the valve seat, and a stop-cock is attached to the other end of the pipe. When required for use, the pipe is simply dropped overboard, with the stop-cock open, and as it sinks, the water rises in the tube. When the tube is drawn up, the action of the valve retains it full of water. When the stop-cock is within reach, it is closed, and the pipe is then hauled in and placed as required. So soon as its mouth is below the sea-level, inside the ship, whilst the valve end is immersed outside, a flow of water at once commences. If the ship has much way on her at the time, a rope must be attached to both ends of the pipe, the filling being accomplished as already explained. Then the valve end being kept forward, the rope attached to it will serve as a guy to keep the ascending leg of the siphon in position, on the other end being drawn into the ship. The common nozzle of a fire-engine is screwed into the stop-cock, and, with a pipe of 2½ inches bore, a flow of from 80 to 100 gallons per minute is obtained. By this simple expedient, a ship's water-tanks can be filled from the water-boat without the use of the force-pump.

REVIEWS OF NEW BOOKS.

A Treatise on the Screw-Propeller. By John Bourne, C.E. London: Longman, Brown, Green, & Longmans, 1852. Pp. 243. Plates and Woodcuts.

(Second notice.)

We make the most satisfactory advance in all scientific improvement when we combine theory and practice, on the mutual improvement system. The art of screw-propulsion has been denied the benefit of such co-operation. Its present position is due to trial-and-error-like deductions from practical experiment. Indeed, theory has hitherto been but a drawback, because it has endeavoured to take the lead; but the repeated failures that attend all attempts based upon mere theory, have at length brought us to our senses, and have induced us to take more rational steps for the discovery of the true principles involved. The great variety of elements entering into any calculation concerning the action of the screw—the continually varying circumstantial influences to be considered—the different modes in which the actuating power may be applied—all require that as large an assemblage as possible of facts and data should be collected, to arrive at a correct understanding and theory of the matter.

Since Smith and Ericsson practically demonstrated the possibility of making some use of the screw, as a propeller, the prejudice entertained against it has gradually given way, and latterly universal attention has been attracted to it. As might be expected, where so many have brought their various talents into the field, very different routes have been pursued in the endeavours made to bring the contrivance to perfection; and, at the same time, that this has given rise to a greater number of data, each resulting from different arrangements and proportions of the elements producing them, these data—the alphabet of the science—are scattered over a very extended surface, and a greater service cannot be rendered to all interested than that of a judicious collection. To render such a service is the object of Mr. Bourne's treatise. An attempt of this nature in itself merits great praise; and an examination into the execution of the self-imposed task does not give us any great cause for qualifying that approval. The subject is undoubtedly a difficult one; and Mr. Bourne has been the first to undertake the production of anything like a complete work upon it. It is easy to correct and improve upon previous efforts, and proportionately greater praise is due to the successful, or even moderately successful, explorer of an untried track.

Mr. Bourne has not, however, limited his undertaking to the mere collecting and recording of the scattered results of past experience. He has done more. He has endeavoured to classify them, and to enunciate the laws which they indicate—doing what is so far possible towards the formation of a correct theory. He has, moreover, added numerous suggestions of improvement; but these demand the test of actual trial, and the critic can, in the meantime, say but little as to their merit.

As stated in our notice* of Part I. of the treatise before us, it opens with a historical account of the different forms of screw-propeller proposed and patented up to the present time. This division of the subject occupies one-third of the whole book—an allotment of space surely far beyond its importance. Notwithstanding this, the descriptions of the various plans are, in many instances, rather meagre. The author has evidently made himself fully acquainted with each, and should therefore have been enabled the more easily to make them intelligible to his readers; but he has fallen into the still easier fault of too great generalization. We should have preferred to see this historical account in, and uniform with, the appendix, at the same time containing fuller and more intelligible descriptive details; and, moreover, confined to such descriptive details—for complaints from many quarters have been called up by the summary manner in which Mr. Bourne has disposed of the merits, whether of originality or efficiency, of the plans of various inventors and patentees.

The recapitulation of the various projects, propounded at different times for propelling vessels by means of a screw, is closed with the pertinent remark, that

"Few have had sufficient vitality to outlive the stimulus of novelty which attended their initial promulgation, and few have been effectual in working out any useful result. . . . . A large proportion of the plans," the author continues, "were susceptible of beneficial practical application. Several of them, in fact, were tried. Nevertheless, up to the time

* Vol. V., page 137.

at which Smith and Ericsson appeared, no permanent or practical progress had been made in screw-propulsion. In 1836, when their patents were taken out, no vessel was in existence which was propelled by a screw."

The narrative, which follows, of the practical introduction of screw-propulsion by Smith and Ericsson, is very interesting. The courageous and energetic efforts of these two poineers of the art are indeed worthy of most prominent record. In alluding to other inventors, Mr. Bourne very reasonably says, that they

"Appear to have been deficient in that persistency of effort which is the main element of progress, and probably, too, circumstances had not ripened sufficiently, at the time they worked, to enable such a quality to produce its natural results. Whatever theory, however, we may form upon this subject, it is at least certain that up to the time at which Smith took up the subject in this country, and Ericsson in America, no practical progress in screw propelling had been made; whereas, since that time, and mainly in consequence of their successes, the progress of the art has been rapid and uninterrupted. I take no account in such a retrospect of small questions of detail. I do not think it necessary to ask whether the particular propellers by which this revolution in the art of steam navigation was accomplished, were better or worse intrinsically than other propellers, whose existence had been limited to paper, or to the sphere of polytechnic toys or ineffectual experiment. It does not appear to be a reasonable expectation, that the best possible forms of screw should be those which were first practically applied, and it was a fair presumption that better forms than any known in the infancy of the system should afterwards be discovered. But as such a discovery could not diminish the credit due to Messrs. Smith and Ericsson, for having practically introduced this new method of propulsion, so neither should it diminish the emoluments properly accruing from their successful exertions. In fact, the introducers of new forms of screws cannot, in equity, be set upon the same level as those by whom screw propelling has been established practically as a new art. The service rendered by the inventor of a new form of screw ends when his invention is superseded by one still more eligible. There, too, should end the profits of his invention. But the service rendered by those who practically establish a new art continues through all its developments, and ends only when the art itself is eventually discarded. Two distinct questions, in fact, here present themselves for consideration. The one is, in what order of mechanical merit we must rank the various projects which have been passed under review; and the other is, to whom, among all the authors of these projects, we are indebted for the practical establishment of the art of screw propelling. Upon the first point it would be hopeless to expect any unanimity of opinion, and those who wish to employ any particular form of screw which is novel, and involves invention, should be prepared to pay the inventor for the privilege. But no such tribute can release them from their obligations to those who were practically the authors of the art, and who have in equity a higher and larger claim than any contrivers of alternative apparatus, since they have overcome greater difficulties and conferred greater benefits.

"The introduction of a new art constitutes a salient feature of an age; and the rewards due to such an achievement should not be grudgingly measured out by the legal standard of merit, which recognises only the conditions of routine practice, but should be referred to a higher tribunal, which, taking cognizance of the difficulties surmounted, and the public benefits conferred, should decide in accordance with the spontaneous dictates of plain sense and plain honesty. In our own country, the persevering struggles of Smith have mainly contributed to the establishment of screw propulsion—a system which seems destined to mark a new and important epoch in our maritime and commercial history: and it would only be a fitting expression of national gratitude if this revolution were inaugurated by conferring on its author national honours, and a national reward; while such an event would harmonize with the tenor of a reign distinguished by its appreciation and encouragement of the arts, and a lively interest in all that pertains to the common weal."

Having expatiated on the relative merits of those to whom the present state of the art is due, Mr. Bourne at last fairly enters upon the subject before him—plunging determinedly into the depths of "fluid resistance." After giving a sketch of the doctrines generally held, he proceeds to point out their inaccuracy and vagueness, attributing it

"Partly to the inherent difficulty of the subject, but mainly to the want of independent research on the part of the various authors who have undertaken the elucidation of the subject."

He then very clearly demonstrates that fluid resistance may be considered, generally, to increase as the square of the velocity, and the power required, consequently, as the cube; since, besides having to overcome the increased resistance, it has also to be exerted over a proportionately greater space. Since, however, any given voyage would be performed in proportionately less time, the quantity of fuel required would only increase as the square of the velocity. The increase of fluid resistance to ships is actually in a somewhat greater ratio than the square, varying, also, with different vessels; and Mr. Bourne ascertains

"The power necessary to accomplish any particular speed which may be required, by the equation $\frac{S^3A}{C}$ = horse-power, where S is the speed in miles per hour, A the immerged sectional area of the vessel in square feet, and C a certain number, or co-efficient, which varies with the form of the vessel employed."

The resistance of ships is generally calculated with reference to the area of the immersed cross section; but Mr. Bourne shows that this rule gives results not at all tallying with experiment, and he proposes to substitute a term derived from

"The perimeter of the immersed section, or, in other words, the length in the cross section of that part of the skin of the vessel exposed to the water."

This inquiry into the true doctrine of fluid resistance, at various velocities, is only useful in connection with a consideration of the action of the screw, in so far as a knowledge of it is necessary for a comparison of the results obtained by different proportions of power, so that the actual comparative efficiency of different modes of propelling may be ascertained.

The author next briefly and popularly describes the form of screw most generally adopted, and explains some of the terms used in connection with it. He then proceeds to investigate the phenomena of positive and negative slip, attributing the latter to the fact of the ship's drawing a body of water after her—the screw turning as it were in a nut which travels in the same direction. We cannot say that we are quite satisfied with this explanation; we leave it, however, to others to find a better. It is sufficient for us to know that

"In screws so proportioned as to produce a negative slip, a worse performance has been obtained than in cases in which screws producing an apparent (positive) slip of 10 or 12 per cent. have been employed."

It is easy to be understood why there should be positive slip.

Centrifugal Action of the Screw.—Many observers seem to imagine that when motion is communicated to fluids, by means of a revolving medium, some principle of action of a mysterious nature is called into play. A few, indeed, have thought, by means of centrifugal action, to multiply power, and have all but grasped the long sought "perpetual motion." We conceive that the results of a force acting in a circle may be as easily explained as those of one acting in a straight line. For, as a circle may be considered to be a polygon of an infinite number of sides, just so may any force acting in a circle be considered to be made up of an infinite number of impulses in different rectilinear directions. With regard to the screw, many things may be attributed to centrifugal action. The explanation is short and easy, but it is vague, and requires explanation itself. We think these phenomena may be simply referred to the first law of the action of solid moving surfaces on fluids—namely, that whatever be the direction of motion of such surfaces, the water will be impelled in a direction at right angles to them. If straight lines, representing the impulses given to the water, be projected from a screw-blade at right angles to the surface, and the screw be turned a little repeatedly, and fresh lines be projected in each new position, until the whole circle be filled, it will be found that these lines will diverge obliquely from the axis, assuming altogether the figure of "a frustum of a cone, with the smaller end against the screw"- described by Mr. Bourne as due to centrifugal action. No form of screw-blade can impel the water in a direction parallel with, or crossing the axis—for a surface at right angles to the axis would be a disc, and to a line crossing it, would be a hollow cone, having the same axis. Thus, properties they do not possess are claimed for the screws of the Earl of Dundonald and Hodgson, though these screws will certainly impel the water in less divergent directions, as will be seen, on projecting lines from their surfaces, in the manner before suggested. The parabolic form should be the better of the two, for with it the lines will converge with each other, though not towards the axis. The impulses represented by the said lines may be resolved into two—one parallel with the axis, the other at right angles to it. If the vessel meets with greater resistance, it will affect only the one parallel with the axis; the proportion between the two will consequently be changed, and the angle of the resultant will be more divergent. This greater divergency Mr. Bourne attributes to increased centrifugal action. The original impulse imparted to the water is at right angles to the acting surface; but this direction is immediately influenced by the resistance met with—just as a ball, suspended by a string, is caused by it to diverge from a straight line, when struck; and if the resistance in a parallel direction be very great, as compared with the lateral resistance, the resultant will of course be almost at right angles to the axis. Now, since sinking the screw deeper in the water would increase the lateral resistance, such an expedient would undoubtedly have the beneficial effect anticipated by Mr. Bourne. Indeed, under some circumstances, the lateral resistance would cause the impelled particles to take a direction *less* divergent than that originally imparted by the screw-blade; for if the lines representing the direction of impulse be divergent, they must lie in a hollow cone, and the consequent tendency to the formation of a vacuum at the centre of the cone would occasion a greater lateral or rather hydrostatic pressure acting towards the axis; and, of course, the greater the depth of the water, the greater would be this hydrostatic pressure. "No doubt, even with a deep screw, there will be some centrifugal action, caused partly by the impulse of the propelling blades, and partly by the friction, which will cause some water to adhere to them, and acquire thereby a centrifugal action." The small amount of centrifugal action caused in this way may, however, be counteracted, by adopting the forms proposed by the Earl of Dundonald, Hodgson, or Nystrom of the United States.

THE IRONMAKING RESOURCES OF THE UNITED KINGDOM.—By S. H. Blackwell, Esq., F.G.S. of Dudley. Bogue, London. 1852.

Cotton and iron are the twin-staples of our country. There is, however, this great difference between these manufactures,—that for the raw material of the one we are compelled to resort chiefly to our great trans-atlantic brethren, the bulk of whose population—slave and free—are thus employed, in fact, by us. It is not to be wondered at, that where any raw material, and the article manufactured from it, are capable of being produced in abundance, and the arts and necessities of life stimulate as well to their further increase as to their perfection, the matter should become one of significant importance to a community. We, however, are to a proverb a practical people. We are content to jog on

in our own quiet way—some of us, indeed, "early rising, late taking rest,"—but the majority, satisfied to prepare to-day for the labour of the morrow, and when the morrow comes, to take the bull by the horns—to put their shoulder to the wheel—figurative expressions of no inadequate force—and to complete with all our skill that which was intended, trifling as it may be, but becoming magnificent in proportion as it forms a unit among millions of similar efforts. Mr. Blackwell has rested an hour upon his oars, and, taking a wide survey of the department of industry, which claims his daily attention, he has detailed the results of his view here with great pains and accuracy.

The history of our subject may be divided, as he very justly observes, into two periods:—the first extending from the earliest times of which we have notice of it, down to the period when coal was introduced as the fuel used in smelting; and the second, extending from that time to the present.

It is obvious that upon a subject commanding so extensive a field, there is much to claim great attention and great care—and it certainly has had both at the author's hands. It is also as obvious that our space is too limited to go very minutely into the matter. To review reviewers, to criticise the critics, to do more than passively bow to the verdict of a jury, (for such in himself such an author is,) is almost beyond the constitutional effort of a Britisher. For with a wise discretion, which he somehow learns, he teaches himself to respect opinions founded upon a wider range of evidence than necessarily is often within his grasp; while he naturally distrusts a judgment formed after what he knows may be but a slight survey of the facts upon which just judgment should be founded; and, falling into the contrary extreme, he is induced to rely with an expression of confidence in opinions published in solemn form.

The first conception of the idea of erecting the Crystal Palace was but a result. The building must be made of something. Nothing hitherto used largely for building was adapted for the purpose. The duty on glass was just taken off. Why not a building of glass? But how to connect it together? It was but a thought; and the mind, which had accompanied the eye as it had occasionally roamed over the utilities of iron, and had employed it successfully in raising elegant erections, struck out the *happy* thought which made the great building in Hyde Park not the least among the wonders of the Great Exhibition. We say, therefore, that the architectural idea was a result, and that chiefly of our immense resources in iron and glass making.

In the report of the jury of Class 1, we are told that the production of iron in England, which was only 30,000 tons in 1750, is now 2,500,000 tons. The causes of this enormous development have been, the occurrence of iron ores in layers amongst the coal measures, and the consequent facilities for smelting, and also the frequent occurrence in the coal measures of refractory clay, used in the construction of smelting furnaces, and the limestone needed as a flux. It was to Mr. Blackwell that we were indebted for a collection of examples illustrating, very instructively, this observation, and for which he was honoured with a prize medal.

Of this total, the author informs us, South Wales produces upwards of 750,000; Scotland, 755,000; South Staffordshire and Worcestershire, nearly 600,000; and the other districts about 400,000; and that about two-thirds of the whole are manufactured into wrought or malleable iron, and one-third into castings, or exported as pigs.

As to this increase, he states some very interesting facts. In South Wales, Scotland, and South Staffordshire, there are now furnaces capable of producing 200 tons per week, and even more than this is now being made per furnace, at several works in the two former districts. In little more than a century, we are informed, viz., from 1740 to 1851, the improvements in iron-making have been so great, that two furnaces now produce a larger quantity of iron than the entire fifty-nine furnaces which alone are known to have been in blast in the former year; whilst the general iron trade has so extended itself, that now several single firms produce from four to five fold the entire make of the kingdom in that year. The author attributes this immense increase to the introduction of the system of heating the blast previously to its being forced into the furnace, and which procedure is found greatly to economize the necessary fuel.

We regret we cannot find space for the observations of the author upon the Northamptonshire iron ores; and we would recommend every one interested in the subject to peruse them in the pages under review. As to the supply of this ore, he observes, that it may be said to be, for all practical purposes, "perfectly inexhaustible, and one the importance of which it is scarcely possible to estimate."

The almost magical reputation which these ores have attained since their discovery, within but a few months past, is certainly very singular. That which had long been considered as one of the strongest holds of agriculture, is thus likely to become a rival of some of our great manufacturing districts; and who knows what important changes, by means of the now readily available railway transit, may be looming in the future for the present industries of the county. It is very interesting to observe the economical importance of ready land passage, as exhibited in this discovery of these rich ores. It is well known—and tracings may be noticed in many places, particularly at Higham-Ferrers, of considerable workings having been carried on in ancient times, when wood or charcoal was used for smelting; but the forests on the spot, which supplied the fuel, becoming disafforested, even the rich ore itself became useless, until re-discovered at this time, when a means of its transit to the coal districts has only just become available. This is very remarkable.

The principal causes, however, which have produced the great increase in the quantity of iron manufactured, are, in Mr. Blackwell's opinion, to be traced,—1st, To the increased demand constantly occasioned, in an accelerating ratio, by the rapidly expanding requirements of all our arts and manufactures, and especially by the introduction of the modern system of railways; 2dly, To the improved machinery and apparatus employed; and, 3dly, To the vast and almost inexhaustible supplies of coal and iron which our mineral fields contain.

The lecturer enters, in succession, into a review of the coal measures, and of the various ores produced,—the iron-stones, red and brown hæmatites, magnetic oxides, white carbonates, the oolitic, lias, and clay-slate, with the green-sand, and Wealden iron-stones: mentioning the chemical analyses of all the important ores, and extending his observations not only to those of Great Britain, but Ireland; and he winds up his theme by many excellent remarks upon the areas of the coal fields, the improvements in the manufacture, and the number of hands employed; concluding with some important remarks, with a portion of which we must finish what we have at present to say:—

"It is impossible to conclude our survey of our iron-making resources, without being struck with the vast and almost inexhaustible supplies of iron which we possess, and with the wonderful fact, that the extraordinary demand which railways and other requirements have produced, should have led, not to an increased price, but to the constant discovery of new and cheaper sources of supply. In this respect, the iron trade illustrates most strikingly what appears to be a general law,—that the natural resources of the world are invariably developed at the times when the progress of society most requires them, and when that progress is already such as to enable us to avail ourselves, to the greatest advantage, of new discoveries. Thus with the iron manufacture—at first the stores of fuel which our forests contained, and the iron ores which cropped out at the surface of the ground, were amply sufficient for our purposes; then came the knowledge of the power of smelting with coal, and with this knowledge the steam-engine placed in our hands the vast stores of mineral fuel of our coal fields. The modern system of railways next produced a demand for iron of an unprecedented character, and simultaneously with this demand occurred the introduction of the hot-blast, and the use of the black bands of Scotland. The more intimate connection of the old and new world, by means of transatlantic steamers, is followed by the discovery of Californian and Australian gold,—giving to the commercial and civilized world at large an activity and a movement, such as has never before been witnessed, causing streams of population to flow in unprecedented numbers from the olden countries of Europe to comparatively new regions, and bidding fair to make the vast and magnificent countries of central America and Australia the seats of great and important empires.

"And these populations, not isolated as the colonists of old—not struggling with the long periods of poverty and slow growth—but springing up rapidly into flourishing communities, take all with them into their new homes—the social wants and requirements of the older countries which they have left. Iron steamers will be required to continue their connection with those countries, and to carry on the extensive commerce they will originate; new lines of railroad will be required, not from towns to towns, but from state to state, and even from ocean to ocean. And not only in America are these mighty movements at work, but elsewhere: also in India, with its 150,000,000 of population, railroads must be laid down; the government of that country cannot be held without them; its natural resources cannot be developed without them; the rapidly extending requirements of our cotton manufacture will necessitate this; and every mile of railway that is laid down will lead to the demand for ever increasing the quantities of iron. And even in our own country, the sanitary measures, to which such attention is now being directed, will require an extremely large and increasing supply of iron, both for an abundant supply of water to the dense population of our manufacturing districts, and also for purposes of building, which the rapidly increasing prosperity of our working classes will no longer permit to be overlooked, as in the past. If the increase during the last twenty-five years has been so great, there is every reason to expect an equal increase during the next twenty-five years, as the general requirements of society develope themselves in an equal, if not in an accelerating ratio.

"And now, to supply these requirements, another great source of iron is disclosed to us; to the argillaceous and black-band iron-stones of our coal fields, and the hæmatites of our carboniferous limestones, are added the oolitic ores, with the rich per centage of iron they contain, the low cost at which they can be raised, and their exhaustless supplies. Can this constant progression of means, this development of one source after another, as society requires it, be other than a wise and most beneficent arrangement, which has for its purpose the advancement of society to an ever higher and higher point, and the attainment of that unity amongst all the nations of the earth, which must ultimately prevail."

CORRESPONDENCE.

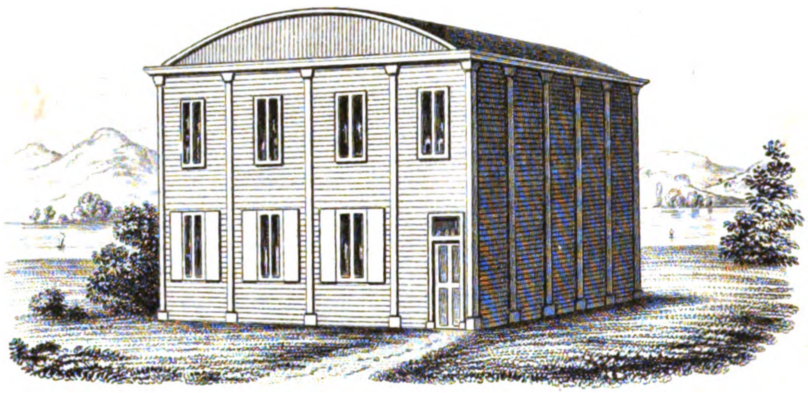
IRONFOUNDERS' CASTING LADLES.

In the last part of your *Journal* there is a paper, by Mr. Hector Short, on foundry ladles, and as he does not appear to be aware of all that has been done towards insuring ease and safety in working such tools, I think it may be useful to him and others interested in the subject, to send you an account of a plan which has been very successfully employed

IRON WAREHOUSE & DWELLING.

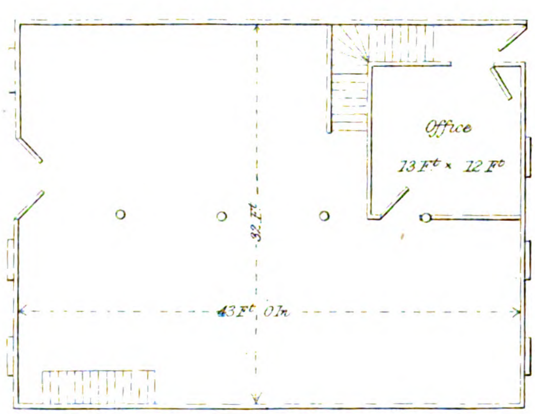
MESSRS EDWD T. BELLHOUSE & Co ENGINEERS,

MANCHESTER.

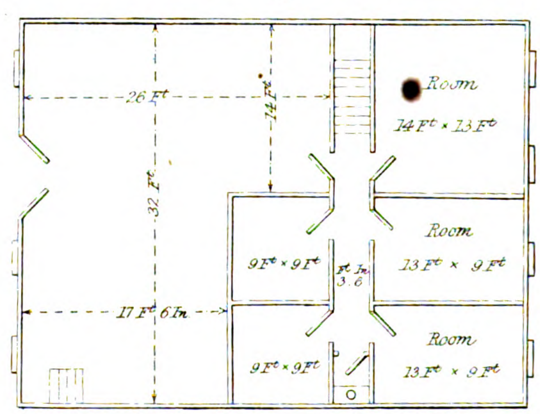


Extreme Length 43 Feet	*Height to Eaves 22 Feet*
Extreme Width 32 Feet	*Rise of Roof 5 Feet*

Plan of Lower Floor



Plan of Upper Floor



SCALE

5 0 5 10 15 20 25 30 35 40 45 Feet

here for about four years. It was first used by the late firm of Henderson Brothers, & Co., and was the joint production of David Henderson, Esq., the managing partner, and myself, and continues to be used by Messrs. J. W. Hoby & Co., of these works.

The aim of the improvement was to make a ladle which would be simple in itself, easily worked, keep the workmen out of danger, and prevent the spilling of metal, in all of which points the ladle with gearing is defective, as, in using it, it is suspended from a crane, and steadied by several workmen at long handles on each side, who have to watch its position, and swing it backwards or forwards to adjust it to the mould, even while the metal is being poured. This is a difficult matter when the quantity of metal is large; and it generally happens that, for want of the means of adjustment, a considerable quantity of the metal is spilt, to the great annoyance of the workmen.

Fig. 1 represents the improved ladle, and the method of working it. It is made of boiler plate; the lower part being hemispherical, and the upper part nearly cylindrical. The gudgeons are formed on a hoop, and are made with square ends, so that long handles may be attached, for turning the ladle about and setting it; but these are not necessarily required during the operation of pouring the metal into the mould. The gudgeons are also set so as to be about $1\frac{1}{2}$ inches behind and below the centre of gravity, thus giving the ladle a tendency to fall forward when suspended by the gudgeons; this, however, being prevented, while it is being swung to the mould, by a strong folding catch on each side, fixed to the run, and taking hold of the two suspending rods, which are attached to a crosshead in the usual manner. The mouth of the ladle is made broad, and projects about three inches, so as to cover a small hook, formed at the upper end of one of the butt strips, connecting the plates. Fig. 2 represents a support for this hook, temporarily fixed to the side of the moulding box; A being the moulding box; B, eyes fixed to its side for the purpose of holding the support, which is adjusted to the proper height by pins through the perpendicular ends resting on B, and is, besides, steadied laterally by means of wedges. When the ladle is filled with metal, it is suspended from a crane, the hook under the mouth placed on the support, and the side catches thrown back from the suspending rods. The ladle is then raised by the crane, when, from its tendency to fall forward, as already mentioned, the mouth continues to rest on its support, and, consequently, the ladle is gradually tilted up, and the metal poured gently into the mould; the whole operation being performed with much less bustle and confusion, and with more safety and precision than by the old method. Another great advantage is that of simplicity, as there is no complicated gearing or machinery about it, to make, or to get out of order, in use; and therefore, it is, perhaps, the cheapest arrangement at present employed for working a large ladle.

Fig. 1.

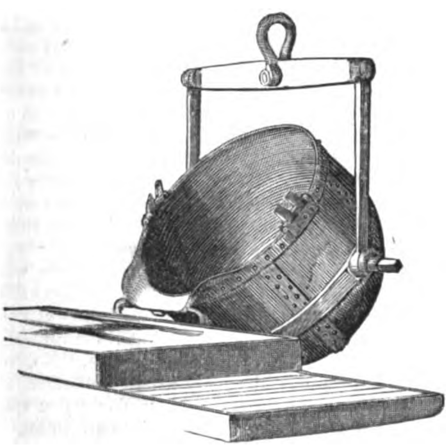
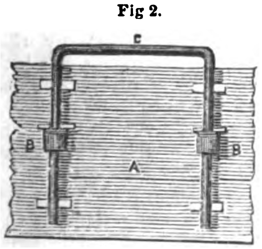


Fig 2.



I cannot help thinking that Mr. Short over-estimates the power required for turning a ladle, for if it be properly hung, there cannot be much more power necessary than what will overcome the friction of the gudgeons. Nor is it at all clear why a ladle for a quantity of metal above five tons, should have the proportional power of its gearing double that of one for less than five tons; or what is the same thing, two sets of gearing, each equally powerful. Then, in the arrangement shown for the largest ladles, the extra gearing appears superfluous; for, should there be a deficiency of power, the simplest method of increasing it must be by simply increasing the diameter of the screw-wheel. Another objection to his design is in having four suspending rods; there would be so much danger in a foundry, from overheating or otherwise, of the four bearings getting out of line, and the consequent risk, or rather certainty, of two of the suspenders taking the entire load. If this did occur the gudgeons would, in all likelihood, get jammed in the eyes of the rods, and if forced to turn by powerful gearing, a break-down would be the almost inevitable result.

GEO. H. SLIGHT.

London Works, Renfrew, January, 1853.

POSITIVE AND NEGATIVE SLIP IN SCREW PROPELLERS.

Many persons appear to be under the impression either that there is no such thing as a "negative slip" in a screw propeller, or that if it actually exists, it must be owing to the peculiar shape of the vessel to which the screw is fitted.

I think that both the "positive slip" and the "negative slip" can be accounted for upon the same principle, and I beg to suggest the following explanation relative to the same:—

If we assume, for argument's sake, a screw of 10 feet diameter, 11 feet pitch, and with a force equal to 3,000 lbs. acting at its circumference to turn it round, to be revolving in a fixed and solid nut, that screw would evidently be capable, during one revolution, neglecting friction, of moving a weight of 8568 lbs., the distance of 11 feet in the direction of its axis; for $10 \times 3{\cdot}1416 \times 3000 = 11 \times 8568 = 94248$. A vessel, however, in passing through the water, will find its own resistance, or weight; and if we assume the same screw to be in connection with a vessel whose resistance at the unit of velocity $= 40$ lbs., and suppose the engine capable of turning the screw at the rate of 100 revolutions per minute; since $\frac{11 \times 100}{60} = 18{\cdot}333$, $(18{\cdot}333)^2 \times 40 = 13444$, and $11 \times 13444 = 147884$, it is evident that the vessel cannot be propelled the distance of 11 feet for every turn of the screw. The effective pitch will, in fact, only be 9·467 feet for $\frac{9{\cdot}467 \times 100}{60} = 15{\cdot}777$, $(15{\cdot}777)^2 \times 40 = 9956{\cdot}6$, and $9{\cdot}467 \times 9956{\cdot}6 = 94248$ nearly. This is the case of the "positive slip," the amount of which is represented here by $11 - 9{\cdot}467 = 1{\cdot}533$ foot, or about 14 per cent.; and this "positive slip" will increase with the resistance of the vessel—that is, the worse the vessel for given dimensions, or the greater the forces opposing its forward motion, the greater will be the "positive slip"—the screw remaining the same.

On the other hand, if the same screw were fitted to a vessel whose resistance at the unit of velocity $= 15$ lbs. only, the engine making but 50 revolutions per minute, and the force acting at the circumference of the screw to turn it round, being therefore reduced to 750 lbs., the vessel again could not be propelled the distance of 11 feet for every turn of the screw. The effective pitch must evidently be greater—viz., 13·126 feet for $10 \times 3{\cdot}1416 \times 750 = 23562$, $\frac{13{\cdot}126 \times 50}{60} = 10{\cdot}938$, $(10{\cdot}938)^2 \times 15 = 1794{\cdot}6$, and $1794{\cdot}6 \times 13{\cdot}126 = 23562$ nearly. This is the case of the "negative slip," the amount of which is represented here by $11 - 13{\cdot}126 = -1{\cdot}874$ foot, or about 17 per cent.; and this "negative slip" will increase as the resistance of the vessel decreases—that is, the better the vessel for given dimensions, or the greater the forces acting in favour of its forward motion, the greater will be the "negative slip"—the screw remaining the same.

Perhaps what is called "resistance of the vessel at the unit of velocity" might be compared, with sufficient accuracy, to a square flat surface of as many square feet as that resistance amounts to when expressed in lbs.; so that in the example relative to the "positive slip," the resistance to the vessel would be equal to that of a surface of 40 square feet, and in the other to a surface of 15 square feet.

It is evident that the "slip" is no criterion whereby to judge of the efficiency of a screw propeller; and, under given circumstances, a screw with a "slip" of 30 per cent. may be better than one with no "slip" at all, or with a negative one.

R. BODMER.

London, December 31, 1852.

[We are afraid Mr. Bodmer "assumes" too much. For instance, in his second case, illustrative of "negative slip," he assumes the diameter to be 10 feet, the actual pitch 11 feet, and a force acting at the circumference equal to 750 lbs. On the other hand, he assumes the ship's resistance to be 15 lbs. at the unit of velocity. Moreover, he assumes the *velocity* of the screw, forgetting that it is dependent on the other elements. He takes that velocity at 50 revolutions per minute; but supposing the engines can be supplied with steam at an equal pressure, when going at a somewhat higher velocity, it is evident the screw

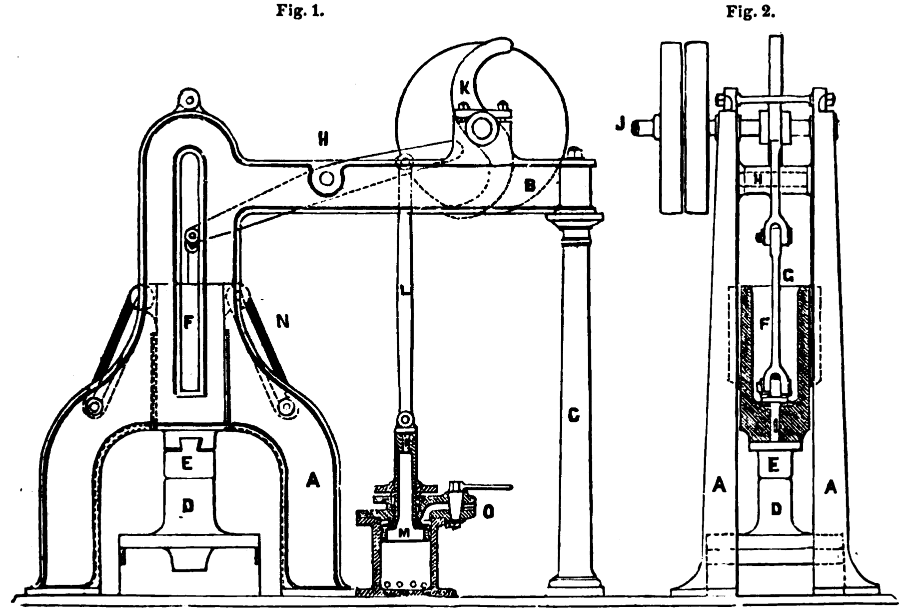
will make—disregarding other considerations—$65\frac{2}{11}$ revolutions per minute; for $\frac{11 \times 65\frac{2}{11}}{60} = 11{\cdot}95$, $(11.95)^2 \times 15 = 2{,}142$, and $2{,}142 \times 11 = 23{,}562$, the resistance of the ship being, as calculated by Mr. Bodmer, $10 \times 3{\cdot}1416 \times 750 = 23{,}562$. If there be a scarcity of steam, of course the screw will make something under 65 revolutions.

In fact, Mr. Bodmer's figures do not seem to touch the question of "slip" at all.—Ed. *P. M. Journal.*]

MECHANICAL OR STEAM HAMMER.

The accompanying sketches represent what I think would be an easily manageable and useful hammer—at least on a small scale—to do the ordinary work of a smith's forge. It has been designed with the view of getting a serviceable tool, which should be capable of being worked from belts, or other convenient movement. The two parallel standards, A, somewhat resemble the ordinary frame of the existing steam-hammers; but two are used, the hammer working between them in vertical slots; and they are cast with horizontal prolongations, B, supported on a pillar, C. All these supports stand on a common base plate, in which is set the anvil-block, carrying the anvil, D, open to the workman through the recesses of the standards. The hammer face, E, is let into the tubular mass of metal, F, in the bottom of which is a joint-stud for the connecting-rod, G, passing upwards to the end of a lever working on the centre, H. It is by this lever that the hammer is actuated, through the short driving-shaft, J, with fast and loose band-pulleys, and a duplex cam or wiper, K, and this cam end of the lever has a pendant rod, L, descending to the species of tubular piston, M, in a short air-cylinder bolted to the base plate, and employed for the regulation of the blow. And, to aid the effect of the stroke, an india-rubber spring, N, is set on each side the hammer, connecting it to fixed studs in the main framing.

Fig. 1. Fig. 2.



3-8th inch = 1 foot.

The hammer is worked by a slow revolution of the duplex cam, as at each revolution of the cam-shaft, the end of the lever is twice depressed. This depression lifts the hammer for a blow, and, at the same time, forces down the piston, M, to the bottom of its cylinder, air being freely admitted to the cylinder above the piston, through a pair of self-acting clacks on the top of the piston, the stop-cock, O, being more or less open, to form a communication with the atmosphere. When a full blow is required, this stop-cock is fully opened, so that, on the release of the lever from its cam, after each depression, the hammer falls with the force due to its gravity, aided by the reactionary tension of the springs, N. If a lighter blow is wanted, the cock, O, is partially closed; and when the hammer is not intended to strike its anvil at all, the cock is quite shut, so that an air-cushion is formed above the piston, for the gentle reception of the entire force of the blow. The air beneath the piston finds a passage through a ring of small holes. The plan may be variously modified. For instance, the hammer itself may be made the air-cylinder, and the air may be compressed in the bottom of the cylinder, to increase the blow; if the shock on the connecting-rods should be too severe, they may be fitted with suitable buffers.

John G. Winton.

Cowlairs, Glasgow, January, 1853.

NORTON'S PROJECTILES.

Expanding Rifle Fire-Shot.—The select committee at Woolwich, in their letter of 17th November last, to the Master-General, have reported that they have successfully tested my elongated expanding rifle fire-shot, in exploding gunpowder placed behind boards. But they also report in the same letter, that they cannot recommend any *expense* to be incurred in testing my rifle shot or shell, from the rifle nine-pounder, or rifle three-pounder, now at Woolwich. The expense of testing the two projectiles would be under two pounds. Some persons are very assiduous in stating, that my rifle shells tested at Woolwich, in the spring of the year 1825, did not carry their fire through the board of the target. The target that I fixed twelve of my rifle-shells into, at one hundred and twenty yards, was made of deal boards, about one inch and a quarter thick. Every shell passed through, and all the perforations were round with the rifle marks, showing that the shell struck *point foremost*, and I have every reason to think they all exploded, but there was no powder behind to show the effect. In the same week, at the Military Colleges of Addiscombe and Sandhurst, the professors had gunpowder placed behind the elm boards, and all who were present know, and the Honourable East India Company well know, that the gunpowder was exploded. The late Sir Augustus Frazer was one of the committee present on the occasion at Woolwich: my hand and eye being at that time steady, I offered to stand at three hundred yards distant from the target; he said, "No, one hundred yards will satisfy us." I affected an amiable simplicity, and said, "Would you venture to fire one of these shells into an ammunition waggon at one hundred;" he replied, "You can safely do so;" and the gallant and experienced officer was as good an authority as I ever knew. I mention this fact, to reassure several officers whom I have heard say, that they would not like to be within five hundred yards of an ammunition waggon on such an occasion. J. C. Hannington, Esq., proved at the Pigeon-house Sands, near Dublin, six months ago, that my rifle shells would carry their fire through a two inch deal board, at the distance of twelve hundred yards: my rifle fire-shot will do so likewise.

Catamaran Percussion Petard.—On the 23rd December, E. Pike, Esq., of this city, having liberally afforded me every facility, in his shipbuilding yard, I breached *through* a plank of seasoned oak six inches thick, with my catamaran percussion petard, the *modus operandi* being the same as that used in my previous practice at Haulbowline, and published in the Cork Constitution, Naval and Military Gazette, and Morning Herald. On this occasion, the percussion cartridge was one ounce and a quarter of Augendre's gunpowder. I mixed common gunpowder with it, in the proportion of about one-sixth of the whole. I am indebted to Dr. Nash of this city, who kindly made me acquainted with this *safe* and powerful explosive agent. The "Million of Facts" for last year gives the component parts of this powder, and calls it a new gunpowder. Breaching "an arch of the bridge" is now an accomplished fact. The English and Irish public take a lively interest in all that relates to improvements in naval and military armaments, for they have the good sense to know, and the candour to acknowledge, that such are their best safeguards against foreign and domestic foes. This percussion petard "sudden and quick to dare and to do," is the best Christmas gift I can respectfully present to England and England's crown.

On the 10th January, at Haulbowline, in presence of Captain Quinn, commanding Her Majesty's Ship *Ajax*, and his officers; Captain Purvis, Secretary to Rear-Admiral Purvis, commanding at Cork; Major Shadforth and officers of the 57th; Mr. Wentworth, R.N.; Mr. Eden, Head Storekeeper; Mr. Bernard, &c., I successfully tested my submarine petard, or catamaran percussion shell; the first experiment was on a plank of deal four and a half inches thick, the charge of the cartridge being two ounces of *Hall's* gunpowder. The petard, firmly fixed to the lower end of the catamaran beam, six feet in length, was suspended one foot above the

plank to allow me space to insert the cartridge; when all was ready, on the iron bolt which supported the beam being pulled away by one man, the petard fell perfectly vertical on the plank. The cartridge exploded with a very sharp report, and the plank was shattered into several pieces. The second experiment was on a sound oak plank, seven inches thick; the cartridge on this occasion was charged with two ounces of Augendre's gunpowder, the oak plank, about four feet long, was breached through its whole length. These experiments were made by orders from the First Lord and Board of Admiralty. Captain Purvis, Secretary to Rear-Admiral Purvis, and Mr. Tucker, Engineer to the *Ajax*, evinced great intelligence, and a lively interest in the proceedings. I use a circular piece of slate, of the inner diameter of the cartridge, for the lower end of the steel tube, with its military percussion cap, to rest on; this insures ignition, even on a plank of soft deal or other timber. The elevation of one inch above the plank would afford a sufficient fall to insure ignition, but I wanted the space of one foot to allow me to insert the cartridge, the last operation previous to drawing out the iron bolt. Here is a new and most powerful war engine added to the armaments of England. There will be always found in the British navy officers of genius, energy, and courage, to successfully apply this engine on all fitting and honourable occasions. There are who opine that such conclusive experiments in war engines are of public interest.

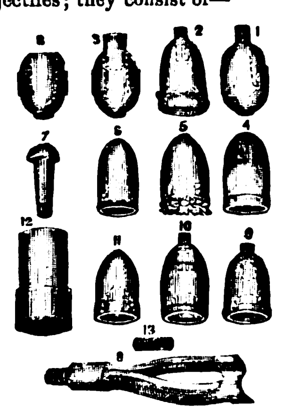
Deeming the subject one of interest to the readers of your excellent *Journal*, I herewith transmit you drawings of several further varieties of my projectiles, together with a short description of each.

I have read Oudeis' letter, objecting to the construction of my concussion fuze, No. 9,* in my diagrams. It was, perhaps, natural for him to make some of the remarks, for, in order to distinguish the *loop* of the slow-match, only a few strands of quick-match are represented instead of a full *bunch*. I have frequently, previous to writing on the subject, tried to draw the loop, supported by the strands, through the tube with the full power of my hands, but was unable to do so; but when I ignited the strands so as to fire the slow-match, then throwing the fuze, with force on the ground, the attached bullet, by the shock or jar, caused the burning slow-match to start out. I am obliged to Oudeis for the good taste with which he prompted me to give this additional explanation. In writing, I strive to *condense*, and that sometimes leads to obscurity. There are many ways by which I can support the slow-match in its place till after the shock of firing the gun, or mortar. A pin of fusible metal, or block-tin, will do it. Then a *real* feather spring, crossing the slow-match near its lower end, supports it during the flight of the shell through the air, and gives way by the shock or jar of striking the object. I have seen shells (not my own) exploded at the muzzle of the gun, but the fragments passed onward. The artillery officers apprehended no danger. Besides, in experimenting with my concussion fuze, there is no necessity for putting the *full* bursting charge into the shell. The *arch* of the loop of the slow-match is prepared as quick-match, and the feather can be graduated, or rather "modulated," to suit any degree of shock.

JOHN NORTON.

Victoria Hotel, Cork, January, 1853.

[The annexed engravings represent Captain Norton's additional projectiles; they consist of—



1. Shell of 1823, with tin chamber or tube, and an iron cup bottom within the shell.

2. Shell with hollow chamber in front, which may be used either as shell or shot, with or without the percussion appliance (also of 1823).

3. Shell having an iron bottom within, and to contain a larger charge, which, when charged with percussion powder, may have a wooden plug in the place of a percussion cap. This shell may be used as a shot for a rifle-pistol, and will contain its own full charge, like those deposited several years since at the United Service Institution;—the iron cup, in the latter case, is unnecessary.

4. Iron or steel conoidal rifle shot, similar to that exhibited in 1828, near Woolwich, in presence of Col. Jones, R.A., and afterwards presented to the United Service Institution in 1833, as recorded in the *Mechanic's Magazine* of the 15th June of that year. This may also be converted into a shell, by having a hollow tube drilled in its front, and, with the percussion appliance, is certain to explode on striking sound oak timber or other hard wood.

5. Fire shot, with slow-match, suggested by the explosion of the French ammunition waggons at the battle of Busaco, in 1810, caused by a shot or shell fired from the Portuguese battery of Major Victor von Arentschild.

6. Ordinary hollow expanding rifle shot.

7. Tin tube with iron bottom, forming chamber of shell.

8. Spring tongs for drawing the charge, shot, or shell.

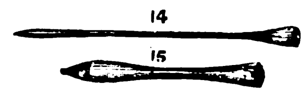
9. Shell with block-tin percussion plug.

10. Shell fitted with percussion appliance.

11. Fire shot, without slow-match attached at its base.

12. Elongated steel punch-fronted rifle shot.

13. Percussion appliance, being a tin tube with copper cap at each end, and cotton thread wound round between the caps.



14. Expanding arrow for Malay tube.

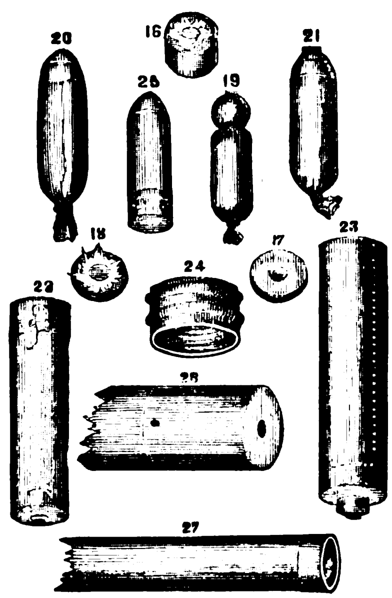
15. Rifle arrow with percussion cap.

16, 17, 18. Percussion primer of cork, or papier-maché, water-proof, and requiring neither pillar nor nipple—applicable to all arms.

19. Improved cartridge for the musket, the ball being one size smaller than the bore of the piece, and the thin, fine, tough folds of paper being equal to one fold of the present cartridge-paper; the ball part being previously greased with a preparation of bees' wax and tallow, the paper does not become creased or uneven.

20. Cartridge with cylindro-conoidal shot for the rifle, prepared in the same manner.

21. Catamaran percussion petard, to act on a ship's side, either on a level with, or above, or below the water-line.



22. Percussion cartridge for this petard, having a front of thin sheet-iron, copper, or slate—a tube of *steel* of equal length being placed within, charged with gunpowder, and having a military percussion cap on each end, with thin gutta percha or tracing paper interposed. This cartridge is the same for petard, rifle, shell, or blasting purposes—all being on the *highest pressure*, no *safety-valve*, steam-boiler exploding principle.

23. The breech of a musket or rifle barrel, having a central cavity to receive the percussion primer without a nipple.

24. Gutta percha fuze screw-cap, similar to Beltzung's patent bottle stopper, which will prevent such fatal accidents as occurred on board the *Medea* and *Excellent*, from using gun-metal screw-caps.

25. Cylindro-conoidal iron shot or shell, having a dove-tail shank at the base. This being inserted into a smooth gun-barrel, with the base up, and on a level with, or a little below the muzzle, and being temporarily supported by a tight cork, melted lead is poured round the shank, this being previously tinned to cause the lead to adhere firmly. This shot may be used in a rifle of the same calibre, as, on firing, the lead will expand into the grooves.

26. Lower end, or front, of the Catamaran beam, cut to fit into the cavity for it in the petard, being secured with three screws at equal distances apart.

27. Lower portion of wooden rammer, with its expanding leaden base, for the percussion blasting cartridge. The lead expands on the principle of the elongated rifle shot, and does away with the necessity of tamping.

In 1844, Captain Norton invented a very simple and efficient plan of defending houses by means of hand grenades. The grenade was hung on a nail in a slanting tube in the wall, by means of the quick-match, which was knotted. The quick-match could then be lighted without danger, for with it the means of suspension would be consumed, and the grenade would fall among the assailants.—ED. P. M. JOURNAL.]

* See *Practical Mechanic's Journal*, Vol. V., page 213.

IRONFOUNDERS' CASTING-LADLES.

I have to thank you most warmly for the earnest manner in which you have treated my communication of last month on this subject. At the same time, I may remark that an error has arisen in placing the decimal point on the wrong side of the figures 1188 in the formula. This ought to be—

$$\frac{\cdot 1188, \text{ ladle's contents in lbs.}}{2513\cdot 75} = \text{ratio of screw-wheel's diameter to ladle's diameter.}$$

Perhaps some of your readers may be able to furnish a reply to the following question, which is of much importance to all connected with foundry operations:—

The sectional area of a cupola at the tuyeres, as well as the pressure of the blast in inches of water being given, what is the least sectional area of blast-pipe necessary to insure the greatest efficiency—that is, the greatest melting power with the least quantity of coke? The very great difference in the relative areas of cupola and blast-pipe, with the anomaly, seen in some foundries, of large cupolas and weak blast; and in others, smaller cupolas with stronger blast, with as great or even greater area of blast-pipe—added to the results of some of my own experiments, very much at variance with generally received views—all combine to assure me that the subject is far from being properly understood.

Hector Short.

Poplar, London, January, 1853.

TAYLOR'S PENDULUM STEAM-ENGINE.

I am strongly impressed with the idea, that the form of engine depicted in my accompanying sketches will effect a material saving in fuel, whilst its simplicity must involve cheapness in first cost. I shall, therefore, be glad to see it in the pages of the *Practical Mechanic's Journal*, in order that it may come under the notice of the many experienced and able readers of that work, and thus enable me to receive the views of practical men upon its merits.

Fig. 1. Fig. 2.

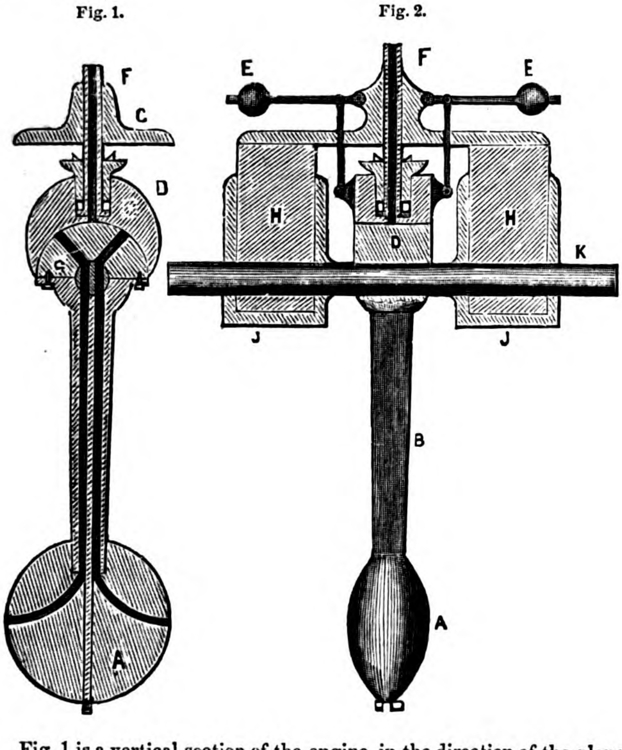


Fig. 1 is a vertical section of the engine, in the direction of the plane of oscillation; and fig. 2 is a corresponding section at right angles to fig. 1. The pendulum bob, A, is suspended from the lower end of the tubular rod, B, which has two longitudinal passages through it. The pendulum cap, C, is a semi-cylindrical piece fast on the head of the rod, B, and working steam-tight against the hollow of the fixed brass-piece, D, which is held down on the cap by the weights, E, hung to short levers, actuating rods passing down to the piece, D. The steam supply-pipe, F, communicates with the boiler, and passes through a guide-plate, G, terminating in the piece, D, by a connecting stuffing-box. The whole engine is supported by the two parallel beams, H, by means of two clamp-pieces, J, having within them the brasses for carrying the horizontal axis, K.

When at work, the steam passes in by the pipe, F, but when the engine is on its dead vertical centre, as drawn here, the current can get no further than the top of the cap, C. But if the pendulum is pushed to the right or left by hand, the steam will rush down through one of the inclined openings in the cap, C; thence passing along the corresponding thoroughfare in the pendulum rod, and finally escaping, in a jet, by the curved port on one side of the pendulum weight, A. The reaction consequent upon this effluent jet then moves the pendulum-weight in a direction opposite to that of the current. This oscillation then brings the other steam-passage into communication with the steam supply-pipe, and a steam-jet is at once produced on the opposite side of the pendulum for the return oscillation. This, of course, goes on so long as the steam is supplied from the pipe, F; and the movement may be communicated to a beam keyed upon the axle, K, which motion may thence be turned into a rotatory one, by actuating a shaft by an arrangement like that adopted in Pow & Fawcus' windlass.

To find the power of an engine of this kind, multiply the pendulum weight by sixty times the ratio between half the length of the reciprocating beam and the geometrical length of the pendulum, dividing the product by 33,000.

Jeremiah Taylor.

St. Vincent, November, 1852.

THE LATE ST. GEORGE C. S. DAVIS, ESQ., ENGINEER, R.N.

Out of a crew of 330 men, the *Dauntless* screw frigate has lost the better part of 100 at Barbadoes, by that terrible scourge of humanity—yellow fever. The officers have been the greatest sufferers; and in the long and sad list of their deaths, we very deeply regret to find the name of Mr. St. George C. S. Davis, a young engineer whose pen and pencil have often enriched the pages of the *Practical Mechanic's Journal.* Mr. Davis was the son of the late Commander G. E. Davis, R.N., and, in early life, held an official position in a Government dockyard, where he became well-grounded in practical ship-building, in combination, more especially, with marine engineering. He afterwards went to sea in his father's ship, the *Bull-dog;* and at the time of his death, at the early age of 25, he had become second assistant engineer of the *Dauntless,* having been at sea some half dozen years.

His contributions to this *Journal* date as far back as our Part 20, vol. ii. Under the signature of an "Engineer, R.N.," he wrote the two very interesting papers on "Chinese Mechanism," at pages 87 and 225 of that volume—both which articles testify alike to his care and attention as an observer, his piquancy as a writer, and his ready and persevering industry with his pencil. Each of our later volumes bears some marks of his practical information, and the freedom with which he communicated his impressions—his signature being latterly changed to "Aladdin." Of his more important literary productions, we may particularise "The Experimental Squadron of Frigates"—(p. 33, vol. iii.); "The Portuguese Exhibition of 1851-2—(p. 258, vol. iv.); "Remarks on some Properties of the Screw-Propeller"—(p. 121, vol. v.); and the leading article in our last number, "The last Experimental Screw Squadron of the Navy"—the two last being unmarked by any signature. Before the last-mentioned paper emerged from the press, its author was dead—leaving us to reflect that

> "Reading is an unremembered pastime; but a writing is eternal;
> For therein the dead heart liveth, the clay-cold tongue is eloquent,
> * * * * * * * *
> And so the mind that was among us, in its writings, is embalmed."

Mr. Davis was an eminent example of what sheer perseverance can accomplish. He never passed through any pupilage with an engineer, but he yet made himself thoroughly master of his profession, from the designing of a ship and engines, to the dressing and grinding his workshop tools—remarking to us, with the judgment of an older man, "I wish to take my stand on what I can do—not upon how I learned it." What he had learned may be partially gathered from the writings to which we have referred.

The *Idler* has left us the injunction, "Let it always be remembered that life is short, that knowledge is endless, and that many doubts deserve not to be cleared. Let those whom nature and study have qualified to teach mankind, tell us what they have learned, while they are yet able to tell it, and trust their reputation only to themselves." The subject of our little memoir might have read and studied this passage, for he has indeed told us what he had to relate while there was yet barely time.

We have reason to know, that, totally apart from his professional standing, he was held in the highest estimation in private life. He spent

the last few days of his existence in visiting and consoling the sick and dying on the fearful scene around him; and his death-bed saw him writing letters of sympathy to the bereaved relatives of his poor messmates, whose departure was so slightly in advance of his own. The closing remarks of Dr. Hawkesworth, on the completion of his last chapter of the *Adventurer*, suggestive, as they are, of deep contemplative thought, and evidencing so completely the true appreciation of the writer's position, and the climax to which he had attained, may be fitly quoted here, as bearing upon the relation existing between our late valued contributor, and the readers of these pages: " But the hour is hasting, in which, whatever praise or censure I have acquired by these compositions, if they are remembered at all, will be remembered with equal indifference, and the tenour of them only will afford me comfort. Time, who is impatient to date my last paper, will shortly moulder the hand that is now writing it in the dust, and still the breast that now throbs at the reflection: but let not this be read as something that relates only to another; for a few years only can divide the eye that is now reading, from the hand that has written."

MONTHLY NOTES.

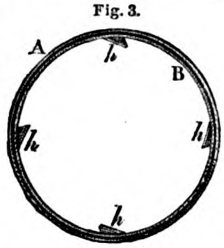
LECLERC'S HYDRAULIC FIGURES FOR JETS D'EAU.—*Sapiens est in loco desipere.*—We may sometimes find space to discourse on pleasant trifles; but lest our graver readers should vote our trifling a serious matter, we have taken the precaution to fortify ourselves with the opinion of a somewhat older man — an opinion, indeed, which has been read, marked, and learned for a good many centuries back. M. Leclerc is a Parisian pump-maker, who has not thought it beneath him to do something in the way of improving the effect, and adding to the interest, of the dancing ball of the miniature cascade. Fig. 1 of our engravings is a front view of a grotesque human figure—a jovial tapster-like fellow withal—substituted by M. Leclerc for the ball. Fig. 2 is a vertical section of the figure at right angles to fig. 1, drawn on an enlarged scale; and fig. 3 is a horizontal section corresponding. The figure is formed out of one or more pieces of very thin metal, A, worked into shape by a die, and coloured externally according to fancy, and having in its interior a cone, B, also of thin metal. The whole is made as light as possible, and perfectly balanced on its centre; and in the interior, near the base of the cone, are four little inclined planes, *h*, so arranged that the impinging action of the aqueous jet beneath may cause the figure to rotate, and thus insure a perfect balance above the jet's centre, and at the same time give the figure a vivacious and pleasing effect. Such figures were originally made with the cone only of metal, the rest being mere pasteboard, so that they speedily got out of order, the water rapidly soaking through the pasteboard as through a sponge, and quickly destroying the part. M. Leclerc's idea is a decided improvement. Besides being more durable, his figures are lighter, and susceptible of a sharper and finer finish. An innumerable variety of amusing devices may be designed on this principle. We may finish as we began—*Nihil est aliud magnum quam multa minuta.*

Fig. 1.

One-fourth.

Fig. 2.

Fig. 3.



One-half.

CAN NOTHING BE DONE TO SECURE SOUND WELDING?—The result of the inquiry into the recent fatal railway accident on the London and North-Western Railway at Harrow, brings before us more than one subject for profound consideration. The evidence shows, first, that the engine left the rails owing to the fracture, and flying off, of a tyre; and second, that such fracture arose from defective welding. The engine, No. 289, was a new one, out of a lot of ten lately made by Messrs. Sharpe, of Manchester; and at the time of the accident, it was running on a straight piece of line, at about 37 miles an hour. The driver, George Grace, had been 12 years on the line, and had worked the engine most satisfactorily for a month. Mr. Sharpe, the maker, who came before the coroner with a practical manufacturing experience of 27 years, 15 of which he had spent as a partner in the eminent firm which he represented, said that the engine had been made for the company at a set price, without any tendering, and that they were bound down to use the best materials, and tyres made by the Patent Shaft and Axletree Company, well known as producing excellent work. He did not think that the broken weld gave evidence either of soundness or unsoundness, as the fractured surface had apparently been subjected to friction since the breaking took place. This firm had made 730 engines, and he was aware of only three instances of similar fractures: every care was taken to prevent defects in welding, but he could not suggest any mode of preventing such accidents in future. Mr. Edwin Clarke, now the engineer of the Electric Telegraph Company, and whose connection with the constructive details of the Britannia Bridge ought to give weight to his statements, pronounced the iron of the tyre to be of unusually good quality, and that a defective weld was the sole cause of failure, there being apparently 2-5ths of the sectional surface not in cohesion. He also spoke of the great difficulties attending the welding process, remarking that a temperature too high or too low was equally bad, the colour of the metal being the principal guide to the workmen, as to the right degree of heat. He did not think that friction had anything to do with the appearance of the fracture, and where, as in this instance, there was no external flaw, he did not know how any internal defect could be detected. In reply to Mr. Sharpe, he said it was true that the fractured surfaces would not now fit to each other, owing to the blows caused by striking the under part of the engine, where the failure took place, but the abraded parts were easily distinguishable from the bad weld. Mr. M'Connell corroborated Mr. Clarke's views, and explained that there was no mode of testing the tyres when on the wheels; all that could then be done was to submit them to a close examination: about 3,000 tons per annum were welded at Wolverton, and these were tested by stretching blocks. From 25,000 to 30,000 of the present working tyres were welded at Wolverton, and he only remembered one defective weld during the six years he had been at the works. In winding up the inquiry, Capt. Huish said there were 60,000 tyres on the line, chiefly of the company's own manufacture, and out of this immense number very few bad welds were met with; and he combated the assertion as to the inordinate number of accidents on that line, by stating that they had three times the length of line possessed by any other railway, and three times the traffic, so that they might have three times the number of accidents, without exceeding their due proportion. The company ran 300 trains per day, and employed 11,000 servants—each individual of whom had the safety of the public more or less in his hands—so that the occurrence of occasional mishaps could not possibly be avoided. In summing up the case, Mr. Wakley stated the remarkable fact, that during the 12 years for which he had been coroner, he had never yet held an inquest on the body of a first class passenger, although his district was crowded with railways. He had held very few inquests on second and third class passengers, but he was confident that the number of serious casualties would be diminished if the second and third class carriages were padded with ever so rough a material, as he was sure that first class passengers owed their escape very much to the padding. This suggestion deserved the careful attention of railway directors, for there is undoubtedly something in it. But the prevention of defective welding is a point which no enthusiastic practical man ought to overlook, so long as we have to reprove ourselves with the occurrence of fatalities like this, which so suddenly and so shockingly destroyed the unfortunate John Bartholomew, the guard.

AMERICAN RAILWAY AXLE-BOX.—In the United States, where oil is universally used for railway axles instead of grease, railway carriages run 8,000 miles without any fresh oil supply, and without any examination of their axle brasses. In this country, on the other hand, where we use palm oil and greasy compositions, the disagreeable hammering at the axle-box reservoir lids, at nearly every station, is pretty good evidence against our practice, and proves our extravagant usage of time and material. That which is considered the best kind of axle-box in America, was lately patented in this country by Mr. Hodge, and he has put the plan to the test on the London and North-Western line, by fitting up the boxes on the tender of engine, No. 182. This engine has run 6,000 miles in four months, doing all kinds of work, without any additional supply of oil, leaving the axles and brasses in first-rate condition. Fig. 1 is a longitudinal section of this box, and fig. 2 is a transverse section, the journal being shown in position in both views. A wrought-iron collar, A, is shrunk on the axle, and this collar has a ring groove turned in it, to receive the leather protector, B, which is rectangular in shape, and held in position by a back plate, C, screwed on to the box. This leather entirely covers up the only passage into the box; and near its upper end it has a circular hole in it, slightly

Fig 1.

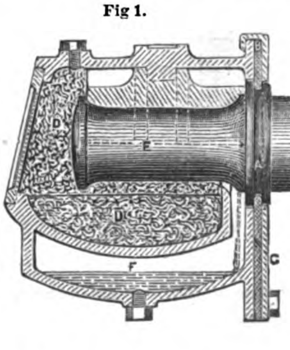
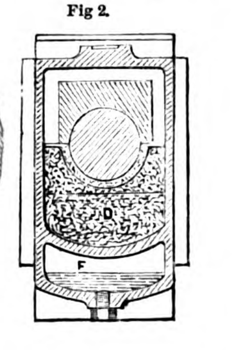


Fig 2.



arger in diameter than the diameter of the grooved portion of the collar, and a short slit being cut in the edge of the hole, it is easily slipped over the collar flange, and then enters the ring groove therein, forming a simple and most effectual barrier against the intrusion of dust or foreign matters from without. The upper chamber, D, of the box is filled with cotton waste, or other material having a good capillary action, rammed tightly in. This carries up the clean oil to the journal surface, E. The lower chamber, F, answers to receive the dirty oil, which finds its way down the space at the back of the bridge wall, and may be run off at a bottom screw hole. The cotton waste is put in dry, and is pressed tightly down from the front, filling up the box except at the axle end. It is then gradually saturated with oil, by pouring it in at the top hole from time to time for several days. After running 6,000 miles, the working surface of the cotton was found to be quite mirror-like, but still saturated with oil, up to the contact surface. During the time of running, 10 quarts of oil were supplied to the boxes, and 5 quarts were drawn off from the bottom chamber in a dirty state, but good enough for screwing and drilling with in the workshop, whilst the oil still in the box is deemed sufficient for 3,000 or 4,000 miles more.

PROVISIONAL PROTECTIONS FOR INVENTIONS

UNDER THE PATENT LAW AMENDMENT ACT.

☞ When the city or town is not mentioned, London is to be understood.

Recorded December 6.

979. William Quarterman, Pimlico—Invention for eliciting the gas concentrated in nitre and sulphur, and which is entitled a gaseous engine.

Recorded December 8.

993. Peter Armand le Comte de Fontaine Moreau, South-street, Finsbury—Improvements in the machinery for applying metallic capsules.—(A communication.)

Recorded December 10.

1015. John Sheringham, 24 Edwardes-square, Kensington—Improvements in the construction of stove grates.
1016. Jonathan C. Blackwell, Edinburgh—Improvements in musical instruments.
1017. Alfred T. Jay, 13 Cheapside—Invention of a safety letter-box.
1018. Thomas A. Smithson and George H. Adam, Kingston-upon-Hull—Improved mode of suspending carriage bodies.
1019. James Derrington and John Chadwick, Manchester—Improvements in cocks and valves for liquids and steam.
1020. Richard A. Brooman, Fleet-street—Improvements in evaporating apparatus.—(Communication.)
1021. Julien Boilesve, 4 South-street, Finsbury—Improved desiccating apparatus.—(Communication.)

Recorded December 11.

1022. Thomas Boardman, Pendleton, Lancaster—Improvements in looms for weaving.
1023. William Rothera, Hollinwood, Lancaster—Improvements in machinery for manufacturing nails, screw blanks, and other similar articles of metal.
1024. George D. Howell, Edinburgh—Improvements in ventilation.
1025. James Martin, 2 Prospect-row, Bermondsey—Improvements in the composition of artificial fuel, and in the mode of manufacturing the same.
1026. Edwin Bates, Welbeck-street—Improvements in breaks for railway engines and carriages.
1027. William Sorrell, Kingsland, Middlesex—Improvements in furnaces and fire-places for consuming smoke.
1028. Archibald White, Great Missenden, Buckinghamshire—Improvements in apparatus for retarding and stopping railway trains.
1029. Caleb Bedells, Leicester—Improvements in reels.
1030. Stephen Green, Princes-street, Lambeth—Improvements in joining earthenware tubes and pipes.
1031. George Dixon, Birmingham—Improvements in the manufacture and refining of sugar.—(Communication.)
1032. Timothy Morris, Birmingham, and William Johnson, Warshwood Heath, near Birmingham—Improvements in depositing alloys of metals.
1033. Charles Ritchie, Hackney—Improvements in apparatus for measuring fluids.
1034. John T. Way, Holles-street, Cavendish-square, and John M. Paine, Farnham—Improvements in the manufacture of glass.
1035. Charles Griffin, Milverton, Warwickshire—Improvements in obtaining metallic copper from its solutions formed by nature, and in the various processes of purifying cupreous ores by means of water.

Recorded December 12.

1036. Josiah Glasson, Birmingham—Improvements in boilers.
1037. Joseph Hamblet and William Dean, Oldbury—Improvement in the manufacture of bricks.
1039. George Mackay, Buckingham-street, Strand—Improved construction of stirrup.—(Communication.)
1040. George Mackay, Buckingham-street, Strand—Improved construction of paddle-wheel.—(Communication.)
1041. Alfred V. Newton, 66 Chancery-lane—Improved apparatus for regulating the density of fluids.—(Communication.)
1042. Jules Lejeune, Auteuil, near Paris, and 16 Castle-street, Holborn—New machine for washing house linen, and all kinds of textile articles that are employed in making them.
1043. Frederick Dangerfield, Broad-court, Long-acre—Improvements in the lithographic press.
1044. David Napier, Millwall—Improvements in steam-engines.
1045. Henry Clayton, Upper Park-place, Dorset-square—Improvements in the manufacture of bricks.
1046. William H. F. Talbot, Lacock Abbey, Wilts—Improvements in obtaining motive power.
1047. Abraham Ripley, Philadelphia-terrace, Westminster-road—Improvements in axles for railway wheels.

Recorded December 14.

1048. James Bell, Portobello—Improvements in railway chairs.
1049. Charles E. Magnant, Paris, and 69 Cornhill—Improvements in tanning.
1050. John N. Taylor, North Shields—Improvements in ships' windlasses and other winches.
1053. Isham Baggs, Liverpool-street—Improvements in obtaining or extracting gold and silver from their ores.
1054. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in fire-grates or fire-places.—(Communication.)
1055. William Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in apparatus for the manufacture of aerated waters.—(Communication.)
1056. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in wind-guards, or chimney tops.—(Communication.)
1057. Josiah G. Jennings, Great Charlotte-street, Blackfriars-road—Improvements in constructing drains.
1058. Rudolph Appel, 43 Gerrard-street, Soho—Improvements in anastatic printing, and in producing copies of drawings, writings, and printed impressions.
1059. Joseph P. M. Floret, Paris, and 16 Castle-street, Holborn—Improved method of producing simultaneously gas light and lime or plaster.

Recorded December 15.

1060. William E. Middleton, Birmingham—A new or improved lubricator.—(Communication.)
1061. Philippe D'Homme, Paris—Improvements in the manufacture of window blinds, curtains, and hangings.—(Communication.)
1062. Susan Walker, Horsham—Improvements in clogs and pattens.
1063. George Elliot and William Russell, St. Helen's—Improvements in boiling down saline solutions.
1064. Jean F. I. Caplin, Strawberry-hill, near Manchester—Improvements in apparatus for preventing or curing a stooping of the head or of the body.
1065. John Mason, Rochdale—Improvements in the processes of bleaching and dyeing textile materials and fabrics.
1066. Alexander Rotscheff, Queen-street—Improvements in machinery or apparatus for separating gold or other valuable substances from earth or other extraneous matters.—(Partly a communication.)
1067. Charles J. Wallis, Clarendon Chambers, Hand-court, Holborn—Improvements in machinery for amalgamating, mixing, and grinding substances together.
1068. Anthony N. Groves, Bristol—Improvements in apparatus for heating, drying, and evaporating.
1069. Richard Taylor, junior, Queen-street, Cheapside, and John Phillips, Upper Stamford-street, Blackfriars—Improvements in treating zinc ores.
1070. Clement Dresser, Basinghall-street—Improvements in combining materials to be used in substitution of whalebone and other flexible and elastic substances.—(Communication.)
1071. Thomas Dunn, Pendleton, near Manchester, Hugh Greaves, Manchester, and William Watts, junior, of Miles Platting, near Manchester—Improvements in machinery and apparatus for altering the position of engines and carriages on railways.

Recorded December 16.

1072. Peter Armand le Comte de Fontaine Moreau, South-street, Finsbury—Improved lamp, which he calls "lamp omnibus."—(Communication.)
1073. André Cointry, of Nantes, France, and 4, South-street, Finsbury—Improvements in the manufacture of bread and biscuits.
1074. John J. Payne, 5, St. Stephen's-terrace, Wharf-road, King's Cross—Improved axle, in two parts, applicable to railway and every other description of carriages and vehicles, both public and private.
1075. Charles Barlow, Chancery-lane—Improvements in bleaching, purifying, and concentrating sulphuric acid, parts of which invention are applicable to evaporating other liquids.
1076. John Healey, Bolton-le-Moors—Invention for the application of glass and enamel to the flyers and other parts of machinery, used in the preparing, spinning, doubling, winding, warping, dressing, and weaving of cotton, wool, flax, and other fibrous materials.
1077. Richard Blades, Liverpool—Improvements in the method of cleansing sewers and drains, and in the machinery or apparatus connected therewith.
1078. James Stephens, Birmingham—Improvements in grinding and polishing lenses.
1079. Sir F. C. Knowles, Lovell-hill—Improvements in the manufacture of iron.
1080. Thomas Motley, Bristol—Improvements in constructing the tablets, letters, and figures for indicating the names, designations, or numbers of streets, houses, buildings, and other places.
1081. Auguste E. L. Bellford, 16, Castle-street, Holborn—Invention of a new system of stoppering bottles and other vessels.—(Communication.)
1082. Archibald Slate, Woodside Ironworks, near Dudley,—Improvement in propulsion.
1083. Archibald Slate, Woodside Iron-works, near Dudley—Improvements in the production of motive power from elastic fluids.
1084. Archibald Slate, Woodside Iron-works, near Dudley—Improvements in propelling vessels.
1085. James Dunlop, Haddington—Improvements in saddles.
1086. George Michiels, 57, Holywell-street, Westminster—Improvements in the manufacture and purification of gas.
1087. George S. Sidney, Willows, Brixton-road, Surrey—Improvements in jugs or vessels for containing liquids.

Recorded December 17.

1088. Henry Kenyon, Liverpool—Improvements in machinery for grinding bones and other substances.
1089. Frederick J. Bramwell, Millwall—Improvements in steam-engines.
1090. Archibald Slate, Woodside Iron-works, near Dudley—Improvements in the arrangements for working the slide valve for the induction and eduction of fluids.
1091. Archibald Slate, Woodside Iron-works, near Dudley—Invention in steam boilers.
1092. Robert W. Billings, St. Mary's-road, Canonbury—Improved apparatus for ventilating chimneys and apartments.
1093. William Wilkinson, Nottingham—Improvements in the manufacture of looped-pile and cut-pile fabrics, and the machinery employed therein.
1094. Alfred Krupp, Essen, Prussia—Improvements in cannons.
1095. John F. Kingston, Carrol County, United States of America—Improvements in obtaining reciprocating motion, and in propelling and steering vessels.
1096. James Langridge, Bristol—Improvements in the manufacture of stays.

Recorded December 18.

1097. Joseph Matthews, Strickland-gate, Kendal—Invention of a burglary alarm.
1098. George Thomson, Dalston, Middlesex—Invention of a machine for cutting wood.
1099. Thomas Y. Hall, Newcastle-upon-Tyne—Improvements in safety lamps.
1100. William Robertson, Barrhead—Improvements in certain machines for spinning and doubling cotton and other fibrous substances.
1101. Thomas Elliott, Stockton-on-Tees—Improvements in steam-engines, which are also applicable to pumps.
1102. Joseph A. Westerman, Sestri Ponente, near Genoa—Improvements in the carbonization of turf, and the manufacture of paper and fuel therefrom.
1103. Edward Schischkar, Halifax—Improvements in dyeing and colouring yarns and textile fabrics.
1104. Edward Schischkar, Halifax—Improvements in colouring or staining yarns and textile fabrics.
1105. Charles C. Boutigny, Evrex, France—Improvements in distillation, and in the apparatus employed therein.
1106. John Clay, Cottingham—Improvements in the manufacture of coal gas.
1107. William East, Spalding—Improvements in machinery for crushing clods, for dibbling and drilling land, and sowing seeds.

Recorded December 20.

1109. Jean Durandean, Paris, and Castle-street, Holborn—Certain means of obtaining marks and designs in paper.
1110. George Lingard, Birmingham—Improvements in taps, and apparatus connected therewith, for admitting air to beer and other liquors under draught.
1111. William Wilkinson, Nottingham—Improvements in the manufacture of paper and pasteboard, and in the production of a substance applicable for veneers, pannels, and to many purposes to which gutta percha and papier maché are applicable.
1112. Peter Armand le Comte de Fontaine Moreau, of the English and Foreign Patent Office, 4, South-street, Finsbury, and 39, Rue de l'Echiquier, Paris—Improved mode of constructing night stools and utensils, water closets, urinaries, and other recipients of fecal matters, also applicable to apparatus for containing fluids, liable to, or in a state of decomposition.—(Communication.)
1114. Charles Watson, King-street, Portman-square—Improvements in carriage and stable brushes.
1115. William J. Silver, 47, Clark-street, Stepney—Improvements in giving motion to capstan and other barrels.
1116. George Gwynne, Hyde-park-square, and George F. Wilson, Belmont, Vauxhall—Improvements in the manufacture of candles, night lights, and soap.

Recorded December 21.

1117. Robert Powell, Berwick-street, Golden-square—Improvements in coats and outer garments.
1118. Ferdinand D'Albert, 4, South-street, Finsbury—Certain chemical combination for replacing indigo, which he calls "D'Albert Blue."
1119. Jean B. Moinier, Rue de Marseille, and Charles C. Boutigny, Rue de Flandre, la Villette—Improvements in concentrating syrups and other solutions, and in distillation.
1120. Jean B. Moinier, Rue de Marseille, and Charles C. Boutigny, Rue de Flandre, la Villette—Improvements in distilling fatty matters.
1121. George Beadon, Creechbarrow, near Taunton—Improvements in constructing and propelling ships and vessels.
1122. John Akrill, Artichoke-hill, near the London Docks—Improvements in the manufacture of bricks, tiles, and other earthenware articles.
1123. Warren de la Rue, Bunhill-row—Improvements in preparing the surfaces of paper and card board.
1124. John Akrill, Artichoke-hill, near the London Docks—Improvements in the manufacture of crucibles.
1125. Edward D. Moore, Ranton Abbey, near Eccleshall—An improved preparation of malt and hops.
1126. William E. Newton, 66, Chancery-lane—Improvements in lamps, and in apparatus to be used therewith.—(Communication.)
1127. John Roydes, Greengate, near Rochdale—Improvements in machinery or apparatus for drawing cotton and other fibrous substances.
1128. Ephraim Mosely, Grosvenor-street—Improvements in the manufacture of artificial masticating apparatus.

Recorded December 22.

1129. Celestine Denis veuve Quinchez, 35, Rue Bourbon, Villeneuve, Paris—A new or improved fabric or texture, which may be used for making mantles, bonnets, and other articles of female attire.
1130. Alfred V. Newton, 66, Chancery-lane—Improvements in the means of urging the fires, and increasing the draught of furnaces, and in arresting the sparks given off from the chimneys of locomotive engines.—(Communication.)
1131. John Roberts, Upnor—Improvements in apparatus for preserving animal and vegetable matters, and for cooling wines and other liquids.
1132. Frank C. Hills, Deptford—Improvements in purifying gas.
1133. John H. Johnson, 47, Lincoln's-inn-fields, and of Glasgow—Improvements in machinery or apparatus for forging iron and other metals.—(Communication.)
1134. John F. Kingston, Maryland, U. S.—Improvements in obtaining motive power by electro-magnets.
1135. William Aspdin, Blackwall, Gateshead-upon-Tyne—Improvements in the manufacture of Portland and other cements.
1136. Thomas Greenshields, Stoke Works, Worcester—Improvements in the manufacture of alkali.
1237. Frederick Ayckbourn, 99, Guildford-street, Russell-square—Improvements in rendering certain materials impervious by air or water.
1138. Thomas Vicars, sen., and Thomas Vicars, jun., Liverpool—Improvements in baking ovens, and apparatus for placing the bread, biscuits, or other articles to be baked therein.
1139. John Livesey, New Lenton—Improvements in lace machinery, and in piled fabrics made from such machinery.
1140. John M. Hyde, 1, Quay, Bristol—Improvements in steam engines and the production of steam for the same.

Recorded December 23.

1141. Alfred J. Hobson, Wallsall—A new or improved metallic bedstead.
1142. John W. Couchman, 8, Princes-terrace, Pultney-street, Barnsbury-road—Safely fastening window sashes.
1143. Alexandre Deutsch, Paris—Improvements in treating oil of Colza, and similar oils.
1144. Christopher Binks, Stratford - Improvements in the composition of paints.
1145. William Westley, Derby, and Richard Bayliss, Derby—An improved fastener applicable to the fastening of window sashes, tables, and other similar purposes.
1146. Nicolas Malinau, Bordeaux, but temporary of 39, Rue de l'Echiquier, Paris—Improvements in stopping or covering bottles, and other receptacles of glass, porcelain, and earthenware, and the machinery connected therewith.
1147. George Gwynne, Hyde-park-square, and George F. Wilson, Belmont, Vauxhall—Improvements in treating fatty and oily matters.
1148. William Roper, 33, Hall-street, City-road—Improvements in shaping and ornamenting sheet metal.
1149. Jean L. David, Paris—Improvements in the manufacture of woollen fabrics.
1150. Peter Fairbairn and Samuel R. Mather, Leeds—Improvements in machinery for carding flax, hemp, china-grass, and jute, and the tow of the several materials before mentioned.
1151. James Davis, Hemel Hempsted—Improvements in machinery for manufacturing bricks and tiles.

Recorded December 24.

1152. Fulcran Peyre and Michel Dolques, France—Improvements in machinery for dressing woollen cloth.
1153. John Hinks and George Wells, Birmingham—A new or improved penholder.
1154. John L. Murphy, Birmingham—Improvement in drawing off liquids from barrels and other vessels.
1155. Joseph Burch, Crag Hall—Improvements in machinery for reaping, loading, stacking, and storing grain and other agricultural produce.
1156. Joseph Burch, Crag Hall—Improvements in machinery, applicable to thrashing, winnowing, cleaning, and sorting grain, and to other agricultural purposes.
1157. Joseph Burch, Crag Hall—Improvements in passenger and other carriages.
1158. William Ramsell, Deptford—Improvements in boilers for generating steam and hot air together or separately.
1159. Robert Griffiths, 25, Great Ormond-street—Improvements in giving motion to drills.
1160. George Michiels, 57, Holywell-street—Improvements in the manufacture of gas.
1161. George Bower, Saint Neot's—Improvements in the manufacture of gas for illumination.
1162. James G. Wilson, Lindsey House—Improvements in the construction of carriages and vehicles for railroads and common roads, parts of the said improvements being also applicable to parts of locomotive engines used on railroads.
1163. Alfred V. Newton, 66, Chancery-lane—Improvements in obtaining and applying motive power.—(Communication.)
1164. Robert Lublinski, Devonshire-street—An improved joint for umbrella and parasol sticks.
1165. William Tuer, William Hodgson, and Robert Hall, Bury—Improvements in the manufacture of textile fabrics, and in machinery or apparatus for weaving, part of which is also applicable to machinery for preparing textile materials.
1166. Pierre C. Nesmond, Bellac—Improvements in machinery applicable to the manufacture of ice, and to refrigerative purposes generally.

Recorded December 27.

1167. John Anderson, Rugby—Heating and ventilating apartments, and for remedying smoky chimneys by a radiant ventilating grate.
1168. George Ingham, Rochdale—Improvements in machinery for drawing cotton and other fibrous materials.
1169. John F. Gordon, Down—Facilitating the turning of four-wheeled carriages, and bringing the front and hind wheels nearer to each other, entitled "The Caster Axle."
1170. George F. Wilson, Belmont, Vauxhall—Improvements in treating certain fatty bodies.
1171. George Gwynne, Hyde-park-square, and George F. Wilson, Belmont, Vauxhall—Improvements in treating fatty and oily matters.

Recorded December 28.

1172. John Mason, Rochdale—Improvements in machinery or apparatus for preparing cotton and other fibrous substances for spinning.
1173. James Darling, Manchester, and Henry Spencer, Rochdale—Improvements in machinery or apparatus for spinning cotton, and other fibrous substances.
1174. William B. Johnson, Manchester—Improvements in steam boilers and in apparatus connected therewith.
1175. Pierre F. Giraud, Paris—An apparatus for the interior of bonnets, to fix them on the head.
1176. Joseph Gidman, Prescott—Invention of a skate.
1177. Edward Mucklow, Bury—Improvements in the construction of retorts for the manufacture of pyroligneous acid, or for other purposes of destructive distillation.
1178. Edward Mucklow, Bury—Improvements in machinery or apparatus for cutting or rasping dye-woods.
1179. Edward Mucklow, Bury—Improvements in preventing the escape or radiation of heat from steam boilers, or generators, and also in preserving marine and other boilers from the effects of incrustation.
1180. William Busfield, Bradford—Improvements in apparatus for combing wool, and other fibrous substances requiring like process.
1181. Ami Bernard, Belfast—Improvements in machinery and apparatus for preparing flax-straw, flax, and certain other fibrous substances, part of which improvements are applicable to machinery for scutching and heckling.
1182. James Webster, Leicester—Improvements in the manufacture of springs.
1183. Claude J. D. Junot, 15, Rue Basse, Passy—Improvements in the mode of reducing several metallic substances hitherto unused, and applying them so prepared to the plating of other metals and substances, by means of electricity.—(Communication.)
1184. Samuel Clegg, 24, Regent's-square—Improvements in apparatus for measuring gas.

Recorded December 29.

1186 John Copling, junior, The Grove, Hackney—Safeguard railway signal.
1187. Henry Kibble, Guildford—Traveller's monitor, or ticket and parcel protector.
1188. John Whichcord the younger, and Samuel E. Rosser, Great Russell-street—Improvements in the mode of burning and applying gas for light and heat.
1189. Benjamin Glorney, Dublin—Improvements in obtaining and applying motive power.
1190. Samuel J. Pittar, Paris-street, Lambeth—Improvements in goloshes or coverings for boots and shoes.
1191. William E. Newton, 66, Chancery-lane—Improvements in the manufacture of carpets.—(Communication.)
1192. Archibald D. Brown, Glasgow—Improvements in the construction of portable articles of furniture.
1193. William Brown, Chapel Hall, Lanark—Improvements in forging, shaping, and crushing iron and other materials, which improvements, or modifications thereof, are also applicable for obtaining and applying motive power for general purposes.
1194. James E. Cook, Greenock—Improved composition for the prevention of the decay and fouling of ship's bottoms and other exposed surfaces.
1195. John W. Friend, Southampton—Improved method of measuring and registering the distance run by ships and boats proceeding through the water.
1196. James Power, Paris—Silvering all sorts of metals and of glass.
1197. Auguste E. L. Bellford, 16, Castle-street—Improvements in machinery for grinding and reducing gold quartz to an impalpable powder, and amalgamating the said ground quartz with quicksilver: the same being applicable also to the pulverizing and washing of ores.—(Communication.)
1198. Auguste E. L. Bellford, 16, Castle-street—New mode of advertising.—(Communication.)

Recorded December 30.

1199. Thomas Walker, Birmingham—Improvements in apparatus for regulating the speed of steam engines.
1200. Thomas Walker, Birmingham—Improvements in apparatus for regulating the dampers of steam-boiler and other evaporating furnaces, which apparatus is also applicable for indicating the pressure of steam or other fluids.
1201. Henry Hutchinson, Sheffield—Improvements in machines for washing bottles.
1202. James Ward and William Burman, Stratford-on-Avon—Improvements in machinery for making bricks and tiles.
1203. Robert S. Oliver, Edinburgh—Improvements in waterproof and other garments.
1204. Julius Singer, Mabledon-place, Burton-crescent—Improvements in wearing apparel.
1205. William E. Newton, 66, Chancery-lane—Improved method of attaching metals to other metals.—(Communication.)
1206. Robert Taylerson, Newcastle-upon-Tyne—Improvements in ship-building.

Recorded December 31.

1207. Thomas Harrison, Hough—Improvements in steam engines.
1208. William M. Pickslay, Brooklyn, New York—Improvement in the blast of furnaces, and which he designates the Calorific Blast, and which increases the effective power of furnaces.—(Communication.)
1209. Thomas B. Smith, Bristol—Improvements in calcining certain ores, and in the construction of furnaces for that purpose, and for converting certain products arising in the process into an article of commerce, not heretofore produced therefrom.
1210. David Dixon, Parson's Mead, Croydon—Improved arrangement of apparatus for retarding and stopping locomotive engines, tenders, and carriages.
1211. James Lord, of the Inner Temple—Improvements in carriage steps.

Recorded January 1, 1853.

1. William Wilkinson, Nottingham—Improvements in taps and other apparatus for filtering and drawing off liquids.
3. John Addison, H.E.I.C., 1, Baker-street, Portman-square, and Henry S. Eicke, 3 Lawn-place, South Lambeth—Making a tessellated pavement.
4. Junius St. John Eicke, 3, Lawn-place, South Lambeth—Deodorizing and preparing American and other resins for mixing with grease, tallows, and wax, so as to improve them, by giving them a greater hardness and consistency, and rendering them less liable to be affected by change of temperature.
5. Joseph J. W. Watson, Old Kent-road, and William Prosser, Adam-street, Adelphi—An improved method of manufacturing steel and of carburizing iron.
6. Thomas Billyeald, Ison-green, and Albert-street, Nottingham—Improvement in the apparatus and arrangement of apparatus for making looped fabrics.
7. Joseph Brough, Longton, Staffordshire—A new manufacture of a vitrified substance and its application, alone or in combination with mineral, earthy, and plastic substances, to various useful purposes in the arts, and for certain other new applications of known plastic substances.
8. John H. Johnson, 47, Lincoln's-inn-fields, and Glasgow—Improvements in the manufacture of oils.—(Communication.)
9. Matthew Tomlinson, Hulme, Manchester—Certain Improvements in the manufacture of "species jars," or show jars.

Recorded January 3.

10. David Hulett, High Holborn—Improvements in the manufacture of ornaments for lamps, chandeliers, and architectural purposes.
11. John Bleackley, junior, Myrtlegrove, Prestwich—Improvements in machinery to be used in washing, bleaching, dyeing, and sizing yarns and fabrics.
12. Edme A. Chameroy, Paris—Improvements in motive power engines, and in the application of motive power to the same.
13. Lazare F. Vandelin, Upper Charlotte-street, Fitzroy-square—Improvements in apparatus for retarding and stopping railway carriages.
14. Charles E. Amos, of the Grove, Southwark—Certain improvements in the construction of centrifugal pumps.

Recorded January 4.

15. Peter Armand Le Comte de Fontaine Moreau, of the English and Foreign Patent Office, 4, South-street, Finsbury, and 39, Rue de l'Echiquier, Paris—Improvements in axle boxes.—(Communication.)
16. Edward C. Shepard, Duke-street, Westminster—Improvements in the manufacture of gas.
17. Joseph J. Welch and John Stewart Margetson, Cheapside—Certain improvements in the manufacture of travelling cases, wrappers, and certain articles of dress, hitherto manufactured of leather.
18. Charles J. Burnett, Edinburgh—Certain improvements in apparatus of mechanism for driving machinery through the agency of water.
19. George Gwynne, Hyde Park-square, and George F. Wilson, Belmont, Vauxhall—Improvements in treating fatty and oily matters.

Recorded January 5.

20. William E. Newton, 66, Chancery-lane—Improvements in atmospheric engines.—(Communication.)
21. Jean Baptiste Pascal, Lyons—Improvements in obtaining motive power.
22. Gustave E. M. Gerard, 12, Rue Hauteville, Paris—Improvements in manufacturing and treating caoutchouc.
23. Gustave Paul de L'Huynes, 21, Frith-street, Soho-square—Improvements in medical portative electro galvanic apparatus.
24. Thomas Shilton, Baddesley, Ensor, Warwickshire—Certain improvements in weighing machines.
25. Charles F. Whitworth, Brighton—Improvements in apparatus to be used in connection with railway signals, for the purpose of indicating the approach of trains, and preventing collisions.
26. Francis Edwards, 26, Park-place, Toxteth-park, near Liverpool—Improvements in the method of lettering, figuring, and ornamenting the surface of enamel, used for dials and other purposes.
27. Frederick Arnold, Devonport—Improvements in heating the water in a bath or other vessel.
28. Herbert N. Penrice, Sheffield—Improvements in propelling vessels.
29. William Bendwell, 4, Great Queen-street, Westminster—Improvements in treating sewage waters and matters.

Recorded January 6.

30. Emile Grillet, Soho-square—Improvements in renewing the teeth of files.
31. William L. Sheringham, Southsea—Illuminating buoys and beacons in harbours, roadsteads, and rivers.
32. Edward Hutchinson, Tyldesley—Certain improvements in the mode or method of preparing, cleaning, drying, and otherwise treating wheat, pulse seeds, and other grain.
33. John Browne, Regent-street—Improvements in the construction of ships or other navigable vessels, and in machinery or apparatus connected therewith.
34. Robert W. Savage, 15, St. James's, Pall-mall—An alarum bedstead.
36. Robert Whinerey, Liverpool—Certain improvements in or upon the manufacture and treatment of leather, either alone or in combination with other materials.
37. Michael Smith, Liverpool—Improvements in machinery for separating gold or other valuable substances from other materials.
38. William E. Newton, 66, Chancery-lane—Improvements in roving, spinning, or twisting cotton or other fibrous substances, which invention he denominates "Larwill's Improvements."—(Communication.)
39. William E. Newton, 66, Chancery-lane—Improvements in the construction of bearings or steps for shafts, turntables, or moveable platforms, which invention he denominates "Parry's Improvements."—(Communication.)
41. Peter Graham, Oxford-street—Improvements in the manufacture of carpets and other piled fabrics.—(Communication.)
42. William S. Ward, Leeds—A thermostat, or apparatus for the regulation of temperature and of ventilation.
43. William Watson, jun., Leeds—Improvements in apparatus for the manufacturing of prussiate of potash.

Recorded January 7.

44. Charles De Bergue, Dowgate-hill—Improvements in the permanent way of railways.
45. Thomas Pape, Loughborough—Improvements in circular frames and in the fabrics and articles produced thereon.
47. Charles W. Lancaster, New Bond-street—An appendage to bullet moulds.
48. George Stewart, Enniskillen—Improvements in railways and in the propulsion of engines, carriages, and other vehicles thereon.
49. Herbert G. James, Leadenhall-street—Improvements in the mode of securing and retaining corks and stoppers in bottles.—(Communication.)
50. Richard Gittins, 2, Thayer-street, Manchester-square—Improvements in tills.
51. Hezekiah Marshall, Canterbury—Certain improvements in the transmission and emission of air and sound.
52. James E. A. Gwynne, Essex Wharf, Strand—The propulsion and supporting of vessels, vehicles, and other bodies on, through, and over the water.—(Communication.)

Recorded January 8.

53. Robert Lovely, Adam-street, Adelphi—Certain improvements in the application of steam to the propulsion of carriages on common roads, parts of which improvements are applicable to the construction of carriages for common roads.
54. Thomas Smith, Lambeth—Certain improvements in soil pans.
55. John Abraham, Birmingham—A new or improved method of manufacturing percussion caps.
56. Henry Kibble, Guildford—Improvements in obtaining a communication between guards, passengers, and drivers, on railways.
58. John H. Johnson, 47, Lincoln's-inn-fields, and Glasgow—Improvements in stoves for cooking, and in apparatus connected therewith.—(Communication.)
60. Richard Walker, Birmingham—An improvement in the manufacture of buttons.

Recorded January 10.

61. Antoine Hiron, Broad-street, Golden-square—Improvements in the means of copying or reproducing models or figures in marble, stone, ivory, or other substances.
62. Charles S. Duncan, Charing Cross—Certain improvements in rendering bottles, jars, and other like receptacles, air and water tight, and for raising and measuring the liquid contents thereof.
63. John Deane, Whitestable—An improved construction of diving helmet.
64. Michael Fitch, Chelmsford—Improvements in ovens.
65. William Webb, 5, Princes-street, Spitalfields—Improvements in the manufacture of carpets.
66. John D. M. Stirling, Camphill, near Birmingham—Improvements in the manufacture of percussion caps.
67. Frederick Schneider, Berne, Switzerland—A chair, to be employed for preventing sea sickness.
68. Alfred V. Newton, 66, Chancery-lane—An improved mode of separating substances of different specific gravities.—(Communication.)

Recorded January 11.

70. William Weild, Manchester—Certain improvements in looms for weaving.
72. James Thornton, Derby, John Thornton, Melbourne, and Albert Thornton, same place—Improved nets and other textile fabrics, to be used for gloves and other purposes, and for the machinery to be employed in the manufacture thereof.
74. Thomas Cottrill, Westbroomwich—Improvements in the manufacture of certain salts of soda.

Recorded January 12.

76. John Horrocks, Seacombe—Improvements in indicating and registering the number of passengers conveyed in public carriages.
78. Nathaniel Card, Manchester—Certain improvements in candlewick.
82. John Arrowsmith, Bilston—New or improved machinery for shaping metals.
84. George A. Huddart, Brynkir—Improvements applicable to steam generators.

☞ *Information as to any of these applications, and their progress, may be had on application to the Editor of this Journal.*

ENGLISH PATENT.

Sealed 11th January, 1853.

Thomas Fields Cocker, Sheffield,—"Certain improvements in annealing or softening metallic wires and sheets of metal; also in reducing, compressing, or drawing metallic wires; also in the manufacture of metal rolls."—January 11th.

DESIGNS FOR ARTICLES OF UTILITY.

Registered from 29th December, 1852, to 17th January, 1853.

Dec. 29th,	3403	D. Hawkins, Stratford-on-Avon,—"Two-wheeled vehicle."
30th,	3404	Villers and Jackson, Birmingham,—"Ever-pointed pencil."
1853.		
Jan. 4th,	3405	Webb and Greenway, Birmingham,—"Bolt."
—	3406	Charles Eyland, Walsall,—"Belt-fastening."
5th,	3407	Charles Eyland, Walsall,—"Belt-fastening."
7th,	3408	Janet T. Hewes, Southampton,—"Ventilating waterproof garments."
11th,	3409	Caleb Hill, Cheddar,—"Stay and dress fastening."
12th,	3410	William E. Kilburn, Regent-street,—"Stereoscopic or binocular case."
13th,	3411	Neild and Collander, Little Friday-street,—"Manifold vest."
14th,	3412	John Paterson, Wood-street,—"Summer collar-tie."
17th,	3413	T. and J. Driver, Minories,—"Bearing and hooks for scale-beams."

DESIGNS FOR ARTICLES OF UTILITY.

Provisionally Registered from 30th December, 1852, to 20th January, 1853.

Dec. 30th,	485	Mr. Shore, Canterbury,—"Music-holder."
31st,	486	James Gurrin, Norwich,—"Wellington shoe."
1853.		
Jan. 1st,	487	Louis Martin, Tenison-street, York-road,—"Rest-head or bridge for billiard cues."
4th,	488	John Simmons, Mile-end-road,—"Face of millstones."
13th,	489	Richard Nicholas, Birmingham,—"Spindle-shot charger."
20th,	490	William Bird, Oxford-street,—"Upper-leather for boots," &c.

TO READERS AND CORRESPONDENTS.

An Apprentice, New-Mains.—There can be only one way of accomplishing the object See "Bourne's Catechism of the Steam-Engine," or Hugo Reid's work on the same subject.

K., Lanark.—Each volume stands for a year, and is therefore made up of twelve Monthly Parts. We also publish double volumes, strongly bound, containing the letter-press of twenty-four Parts, but with the Plates in a separate volume, for facility of reference.

W. C., Huddersfield.—The ordinary regular rate of Messrs. Wright & Hyatt's rotatory engine is sixty revolutions per minute; but, if necessary, it can be made to run safely at 250 or 300 revolutions. It has been inspected by the Duke of Northumberland, and several of the Lords of the Admiralty, who have had an official report upon it from their Engineer.

Metallurgist.—Opacity and transparency are comparative terms, by no means antagonistic to each other. A piece of gold—a sovereign, for example—is opaque; but if we reduce it to a sufficient degree of tenuity, a bluish-green light passes through it. Herschel mentions this fact as one of Bacon's "frontier instances" between the transparency of pellucid bodies and the opacity of metals.

The Caloric Engine.—A correspondent writes to us to draw our attention to Stirling's priority of invention in this matter. Stirling's practical experiments are well known. The plan failed. If Ericsson succeeds, it must be by the aid of something more than the Scottish inventor possessed. Besides, it must be remembered that Ericsson's original experiments date back to some twenty years ago.

Received.—"Recent Improvements in the Construction of Fire-Arms." By Colonel Chesney.—"Compressed Air Power." By Arthur Parsey.—"The Canadian Journal," October and November, 1852.—"The American Telegraph Magazine," No. III.

IRON AS A BUILDING MATERIAL.

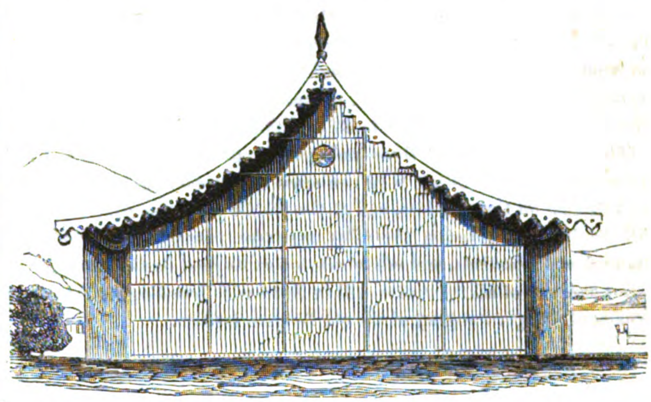
(*Illustrated by Plate* 118.)

Front Elevation.—(Group of three Iron houses, with concave roof.)

Many sequel chapters affecting industrial production might be written on our late text, " Gold and its results ;" for many are the stirring incidents which the gold fever has created even in our remote manufacturing localities. Our baser mineral resources, and our busy manufactories, have alike felt the benefit of this extraordinary movement; and not the least important consequence of the more recent gold discoveries in Australia, and the enormous subsequent convergence of emigration to that region from every quarter, has been the expanding growth of an iron architecture. The capabilities of iron for the architect's purposes have indeed long been known and partially appreciated, but the colonial demand for cheap, portable, rough-and-ready erections, which the early adventurer first requires to cover his head, and then to store and garner in his industrial acquisitions, has imperatively forced this system of construction upon us. The appearance of the very first New Holland gold-seeker afforded an earnest of all that has followed; and the discovery of the first nugget, all but sent home to us a train of orders to the workshops of British mechanics. And this new industrial outlet has been no temporary or mere impulsive start. It has already assumed all the stability attendant upon sound legitimate commercial enterprise. It is told us everywhere in our great manufacturing districts, for the hammer and the loom resound on all sides—far and wide—in their busy occupation, at the cogent instance of the energetic colonists. Such commercial transactions are steadily increasing; and from the construction of bare sheds to shield the rude adventurer as he first struck into unpeopled wilds, we have now advanced to the manufacture and shipment of huge iron warehouses, which are already required for the business purposes of a civilized and closely-congregated community. Such and so rapid has been the progress of the man of commerce along the foot-prints of the pioneering discoverer.

The dearth of labour, universal in countries newly opened up, has necessarily reacted favourably upon us; for in localities where moderately skilled men earn daily something like a week's wages here, it is obvious that the consumers must come to us for whatever we can produce at a reasonable cost, and in a conveniently portable form. This is exactly what we can do in the construction of iron houses, by the aid, more especially, of our many very recent inventions in rolling and shaping the malleable metal, and the simplified modes of producing and combining the moulded details. The simple contrivance of corrugating sheet-iron has, of itself, afforded us great assistance in such constructions. For instance, a flat sheet of iron laid on bearings, 8 feet apart, will not support its own weight—the very mass from which strength is sought, will bear it down to the ground. But if we corrugate this sheet, or give it an undulating or zig-zag section, it will carry a heavy man, under the same circumstances as to width between the supports.

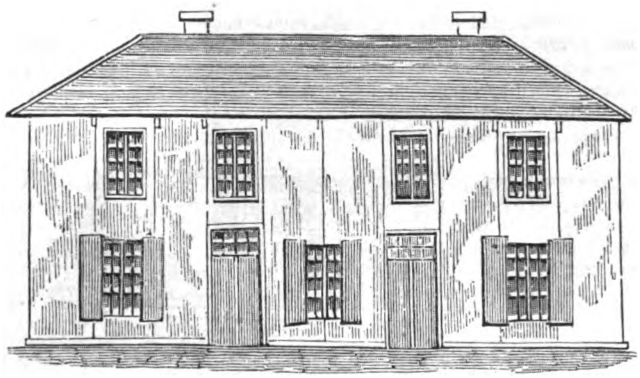
Hence iron buildings are becoming quite a staple manufacture with us. A single Manchester firm, that of Messrs. E. T. Bellhouse & Co., of the Eagle Foundry, Manchester, has just now about a score of such erections in course of construction. These are of all dimensions—from small one-roomed cottages, standing on a base 12 feet square, and costing £50, to two-storied warehouses, with dwellings combined—value, £850. Such a building forms the subject of our Plate 118. The basement of this building is formed by pieces jointed together in lengths of easy shipment; cross-bearers being joined to these to support the plank floor and central columns, whilst, at intervals of 7 or 8 feet, cast-iron pilasters stand upon the basement of the outer shell. These pilasters are in two pieces, joined together at the upper floor level, and provided with sockets for receiving the floor beams, and caps for the cast-iron moulded gutters.



End View.

The corrugated iron sheets, forming the sides of the building, are of 18 wire guage. They are placed with their lines of corrugation in a horizontal direction between the pilasters, the sides of which are so cast that the corrugated contour fits, and is bolted thereto. A cast-iron moulded base-plate is fixed down upon the timber basement, to receive the lower edge of the bottom sheet. On the under side of the cast-iron gutter, a rib is cast for the fastening of the upper edge of the highest sheet, whilst the side of the gutter has a flange to receive the lower edge of the curved roof sheeting.

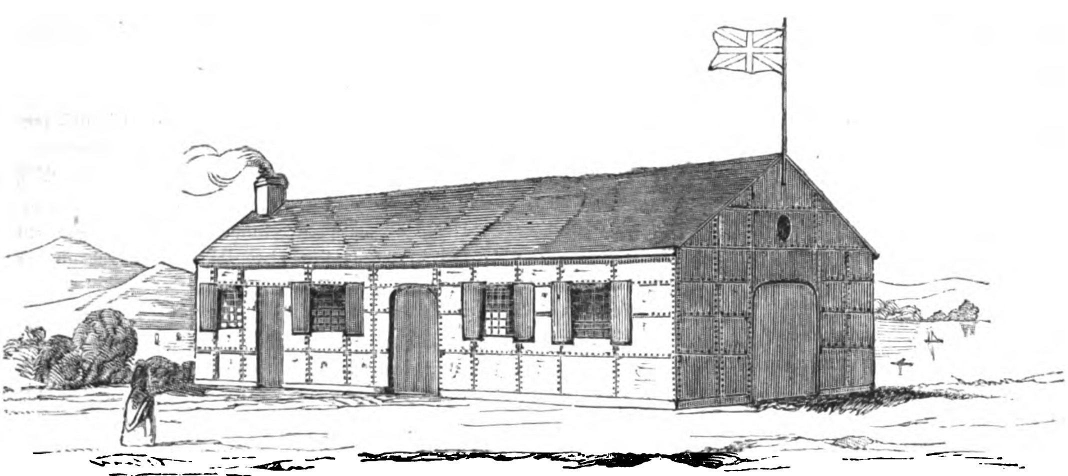
The roof sheets are supported by complete trussed principals of wrought-iron, the extreme ends being each carried on the top of a pilaster, and at intervals angle-iron bars run across the principals, and are bolted thereto, or carrying the curved sheets of the roof, the corrugations of which run across the building.



Front Elevation.—(Iron Warehouse with large Dwelling-house above.)

In the case before us, a central skylight is not required. When it is, the plan of a continuous skylight, rising to a ridge, is recommended, as it removes the only objection to be urged against a curved roof—the want of a slope at the crown of the curve. The warehouse doors are of sheet-iron, riveted to wrought-iron frames, and furnished with stout hinges and fastenings; and the window sashes open inwards, on the French plan—the lower set having wrought-iron shutters. There are no windows at the sides, as it is thought desirable that all the light should be derived from the ends and roof, so that no more land should be required in a lateral direction than the building itself will actually occupy.

The upper floor is of three-inch planks, grooved and tongued with hoop-iron. This planking is laid on cross beams, resting, at the ends, on sockets cast on the pilasters, and at the middle upon the central pillars. All the divisions forming the office, staircase, passages, and rooms, are studded and boarded; and when erected at its final destination, the interior surfaces of all the rooms will be lined with boarding, to receive an ornamental paper-hanging of the old English fashion.



Front Elevation.—(Iron Warehouses.)

The general external effect of this erection is very good—the perpendicular outlines of the pilasters being set off to advantage by the horizontal lines of the corrugated sheets; and the moulded gutter forms an agreeable finish to the upper part of the building, whilst it imparts the effect of stability to the abutment of the curved roof. Indeed, with a judicious selection of the colours for the external painting, this structure will not by any means mar a pleasant landscape scene. The woodcuts scattered through our paper are illustrations of some of the other classes of buildings of this construction, made by Messrs. Bellhouse.

The question as to the two extremes of heat and cold is important, in its relation to iron buildings. A double shell of iron, with an intermediate air space, is the most effectual arrangement for obviating the evils of excessive thermal changes; but, in most cases, such a plan of construction is too costly. The next best contrivance is a thorough lining and ceiling of well-seasoned boards, nailed on battens, and papered on the inside; but a more economical ceiling is made by nailing asphalted felt on battens. A very capital non-conducting roof is made in this way on wrought-iron principals, 6, 7, or 8 feet apart, having rebated 1½ inch boards laid upon them; and over these, a layer of thick dry hair-felt is nailed, with a final external covering of corrugated sheet-iron. Messrs. Bellhouse have recently sent out a church roof of this kind to India—a climate which will certainly afford a good test for the practical value of the contrivance.

In warehouses for ordinary merchandise, it is considered that a single iron shell, with efficient means of ventilation, is all that will be necessary; but where especial care is to be paid to the goods, a better protection will be given, by lining the walls, for four or five feet high, with boarding on battens, and the upper portions of the walls and the ceiling with asphalted felt on battens. Buildings of this kind must add materially to the comfort of the newly-arrived emigrant, whilst they are valuable in many respects for the purposes of the older settler. They are of extremely simple construction; and as, prior to being taken down on their preliminary erection here, each individual piece is marked with a distinguishing figure, in correspondence with reference figures on a guide-plan, prepared for the permanent erection abroad, the whole of the details are easily made out and adjusted by the rudest hands. Our wrought-iron and our ironworkers may expect a lasting demand for their services in furnishing such works.

TRANSPORT OF "CLEOPATRA'S NEEDLE" FROM ALEXANDRIA TO SYDENHAM.

[The vast antique monolith, at present imbedded in the sands of Alexandria, having become, under certain conditions, the property of the Crystal Palace Company, the promoters of that undertaking lately advertised for contractors to remove the monument in a ship to be provided for that purpose. Amongst other proposals sent in to the directors, was one by Mr. Elmes, the well-known architect, who suggested the removal by means of a caisson and other novel appliances, as being safer and more economical than the ordinary mode of shipping. The scheme did not meet with the approval of the directors, and the author has therefore forwarded his detailed statement to us for publication.]

Before submitting my proposal for removing the ancient Egyptian obelisk, known by the name of "Cleopatra's Needle," and the full particulars of the mode in which I propose to effect it, I have to solicit your attention to the great danger of removing it in a ship.

First: To deposit this precious monument of ancient art, of unknown

antiquity, and of incalculable value to historical science from its hieroglyphical inscriptions, on board a ship, it must be laid either on the starboard or larboard side of the masts, and a counter-weight, of the same length, depth, and breadth, of the same dead-weight, which is nearly 200 tons, and as inflexible in material, must be laid on the same level, to balance, or trim the vessel. This dense weight of comparatively small dimensions, with the necessary ballast to put the ship in sailing order, will make it a most dangerous cargo for so long a voyage, however large and otherwise safe the craft may be.

Next: It is an acknowledged fact, that the finest ships ever built, and laden with the best and most manageable cargoes, are liable to be wrecked, or to founder at sea; *à fortiori*, therefore, how much more is this most difficult and most unmanageable cargo in danger from the risks and perils of the seas? If this inestimable cargo could find underwriters to insure it at any premium, I ask whether, in the event of its being lost at sea, would all the money you could, in that case, receive from Lloyd's recover the obelisk? Or, would the payment of the money be more satisfactory to you than was the offer of L. Mummius, to pay for the statues and the pictures he destroyed when he sacked Corinth, to the vanquished Corinthians? Its loss would be as irreparable as the life of Archimedes, when he was slain by a Roman soldier at the siege of Syracuse.

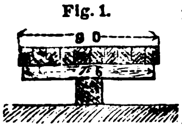
My plan is free from all these objections; and, in addition to being less expensive, it will cause the obelisk to be so perfectly buoyant and unimmersible, that, if abandoned to the winds and waves for any length of time, and in a score of hurricanes, it would still be as buoyant as a cork, and recoverable at any time.

The design was originally prepared for an association of gentlemen, amongst whom the late Alderman Thomas Johnson, the contractor for the Plymouth breakwater, was one, for removing the largest unwrought block of granite, obeliskal in form, at present known, from its parent bed, on the summit of one of the highest *Tors* in the granite district of Devonshire, to the banks of the Thames near Windsor. The long illness and subsequent death of the originator, the mayoralty of Alderman Johnson, and the apathy of their colleagues, caused the intended commemoration by this colossal obelisk to be delayed, and the plans and particulars of the mode of removing it from the rocky mountains of Devon, to the alluvial plains of Windsor, to remain in my portfolio, unsubmitted and unknown to all, but my late friend who gave me the commission and myself. Thus, the incipient commemorative obelisk, 102 feet in length and 9 feet square at its base, remains, for the present, where it has lain for ages untouched, except by the hands and implements of the modern quarrymen. The different circumstances, dimensions, and situations of the two colossal masses in question, rendered it necessary for me to make entirely new arrangements, and an approximate estimate of the cost of removing "Cleopatra's Needle."

Your advertisement requires that "full particulars of the mode in which the removal is to be effected must accompany the proposals." I have not only complied with this condition, but have added mathematical demonstrations of its practicability, and the details of the cost. I shall, therefore, proceed upon the hypothesis of having the work to do, and sufficient funds wherewith to do it. The bill of quantities of the materials requisite for the undertaking, and the amount of labour necessary to accomplish it, given at the end of the following specification of my proposed mode of operation, will prove the moderation of its cost, and the whole, by induction, its practicability.

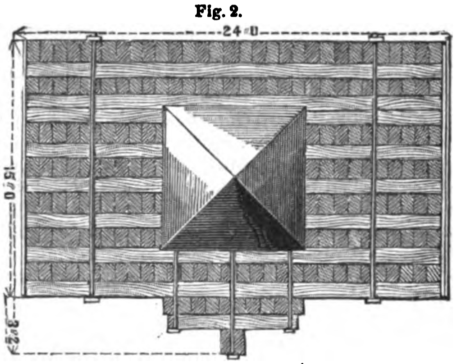
In the first place, I propose to construct a dry dock, at a suitable distance, say from 10 to 15 feet, parallel to the side of the obelisk, 10 feet longer at the smaller end, and 30 feet longer at the larger end, than the obelisk; 25 feet wide at the bottom, and 10 feet deeper than the level whereon it lies, and with inclined sides and ends. Lay 9 pieces of whole fir timber, from 12 to 14 inches square, but all of the same height, 20 feet long, across the bottom of the dry dock, in a transverse direction to its length, at equal distances apart, and 5 feet from the top and bottom of the obelisk. On and in the middle of these transverse sleepers, lay a piece of timber 64 feet long and 14 inches square, formed of two pieces, strongly scarfed in the middle for the keel, and on that lay a series of transverse beams, 7 feet 6 inches long, and 12 or 14 inches square, but of uniform thickness, as close together as possible; every tenth one to be secured to the keel by wrought iron rod-bolts, nuts, and screws. All these timbers are to be dressed by the axe on the sides, so as to lie tolerably close together, and to be well caulked and payed. On this platform lay a series of 9 longitudinal timbers, selected of one uniform size, from 12 to 13 or 14 inches square, as the case may be, projecting gradually at the head, one in six, horizontally—the centre one in a similar proportion, perpendicularly, to be formed into a species of cutwater—and

Fig. 1.



one in twenty horizontally at the stern, till it arrives at 30 feet longer than the larger end of the obelisk. The middle and the two external of these longitudinal timbers are to be scarfed in the middle, and each to be bolted and screwed down in five places to the lower platform. On this tier of longitudinal timbers lay a tier of transverse beams, as close together as possible, each 24 feet long, and from 12 to 14 inches square, which will project over the lower tier 7 feet 6 inches on each side. The head and stern, and three of the intervening beams, are to be well bolted down in three places to the lower tier. On this transverse tier lay another longitudinal tier, similar to the one beneath, and on that repeat another transverse tier, which is proposed to be the bed or platform of the obelisk, laid longitudinally.

Fig. 2.



The operation having been carried on thus far, a solid, compact platform of timber, which is as 700· to 1030· lighter than sea-water, 80 feet long, 24 feet wide, 6 feet 2 inches deep in the centre, and 3 feet deep at the sides, perfectly compact, indissoluble, buoyant, and unimmersible, will be ready to receive the obelisk, which, according to the best authorities, is 64 feet long, 8 feet square at the base, and 4 feet 3 inches square at the top. The upper surface of this platform will then be 4 feet below the level whereon the obelisk now lies. The next operation will be to clear all the earth or soil that may be about the obelisk, and remove as much from under it as can be done without injury thereto. Then construct an inclined plane by excavation, and ten pieces of whole timber, from the lowest level of the obelisk, to within 6 feet of the centre of the platform, measured transversely. The raft, as it may in that state be called, is then to be securely shored up on both sides, to keep it in a horizontal position, till the works are completed. The declination of this plane will be about 4 feet perpendicular in 30 feet horizontal, or in the proportion of 1 in $7\frac{1}{2}$. Cover a surface of the timber deck, 70 feet in length from the head of the raft, and 10 feet wide at its centre, with a layer of Egyptian raw cotton, fastened down by an adhesive coat of liquid gutta percha or marine glue, and make all clear and secure for the next operation.

The obelisk is then to be secured at the head, base, centre, and two intervening places, by bands of flat hempen cable, taken two turns round as many capstans, fixed strongly in the ground; and all encumbrances being removed, it is to be conveyed down the inclined plane to its proper place, which will be amidship, as to the width, and its smaller end 5 feet from the head: as the lower 25 feet of the obelisk weighs about the same as the upper 39 feet. This huge mass will then be laid longitudinally upon a platform of transverse beams, and at right angles therewith.

The obelisk being on the caisson, the next operation will be to lay a longitudinal layer of timber on each side of it, touching its base, and laid parallel to its centre; eight widths on each side, and eight pieces, or feet, allowed for the base of the obelisk, as shown in fig. 2. This layer will leave a space on each side of the stone of about 2 feet wide at the upper end, tapering to nothing at the base. This space is to be filled up with tapering sticks of timber, fitted to within 3 inches of the stone, which interval is to be packed with Egyptian raw cotton, as high as the horizontal timbers, and the interval on the top is to be filled up in a similar way. The next step will be to lay a transverse tier of similar timbers, the entire width of that beneath, perpendicular to the outside, and shaped to the inclination of the obelisk, from base to summit, with an interval of about an inch between their ends and the stone, to be filled in, as before mentioned, with raw cotton; and so on in alternate tiers, longitudinally and transversely, packed, shaped, and fastened down, as before described, till they arrive at the upper surface of the thicker end of the obelisk, which tiers are to be so managed, by selecting timber of such thickness as to be accomplished in such courses or layers, that the bottom and upper tiers may lie transversely across the obelisk. This being so done, the last tier will be level with the base of the obelisk, and about 4 feet higher than the top; which interval is to be closely filled up, as before described, and a tier of transverse timbers laid across the whole, from stem to stern. On this layer of transverse beams, four more tiers, alternately longitudinal and transverse, are to be laid and secured as

before described, increasing in length at the head and stern in the proportion already mentioned. When the caisson is thus far completed, ten circular iron bolts, 2 inches in diameter, are to be inserted through all the timbers which are midway between the obelisk and the outside rows on both sides of the caisson, from the upper surface of the upper tier, down to the lower surface of the lowest of the long transverse tiers, and secured at the top and bottom by iron circular plates, 12 inches in diameter, nuts, and screws, filed off flush, and riveted at the bottom, and forcibly screwed on the upper surface, to fasten the whole together perpendicularly.

Over the whole of the outer surface, or sides and ends of the caisson, fix a perpendicular sheathing of three-inch yellow fir planking, fastened to the longitudinal timbers by a sufficient number of iron bolts and oak trenails, carried up to the height of five feet above the upper timbers, to form a bulwark all round the deck. This perpendicular sheathing is to be covered by another, laid horizontally, of three-inch yellow fir planking, to the shape before described, and fastened on in a similar manner.

As the quantity of yellow fir timber necessary to be used in the construction of the caisson, in which it is herein proposed to enclose and float the obelisk, is about 30,500 cubic feet, and its specific gravity as 700· to 1030·; and as the solid content of the obelisk is 2476·5 cubic feet, its specific gravity being, on an average of five different sorts of Egyptian porphyry, 2723·, and its common weight, on the same average, being 170 lbs. avoirdupois to the cubic foot, it follows that the timber caisson will have to float upwards of 188 tons of porphyry, in one long and narrow dense mass of that material. That is, the caisson will form one compact mass of yellow fir timber, solid and indissoluble, of the common weight of 1,311,500 lbs. avoirdupois, of a specific gravity of 700·; with an internal core weighing 421,005 lbs. avoirdupois, of a specific gravity of 2733·, and will float in sea-water, whose specific gravity is 1030·. In the estimate, I have demonstrated that it will require 430 tons, common weight, of some material heavier than water to sink such a solid mass of yellow fir timber to a level with the surface of still water; whereas, the entire weight of the obelisk, and all the iron work, is scarcely over 190 tons. Therefore, the specific gravity of this mixed mass of timber, porphyry, and iron, will scarcely sink half its depth in the sea. A smaller quantity of timber might, therefore, suffice to float it safely; but, as "a little safer than safe enough" is wise policy in such an undertaking, I propose to employ a larger quantity of timber to comply with this maxim; and as the greater part of the timber proposed to be used will be as good as new for building purposes, there is no necessity of sparing that buoyant material.

To prepare the caisson for use, convert the two thicknesses of sheathing above the deck or upper tier of longitudinal timbers into proper bulwarks, on both sides and ends. Fix a rudder on the stern-post, with all proper ties, machinery and wheel, fit for the purpose. Provide and properly step into the timbers, as low as may be necessary, two masts and a bowsprit, of sufficient dimensions, properly rigged and provided with yards, braces, spars, blocks, gear, sails, and all proper requisites to be used, and to be as jury-masts to a hulk or raft; also a series of cabins, store-rooms, berths, &c., for the master, mate, and crew; with tanks for fresh water, lockers for the master and mate; provisions, and necessary stores for the voyage, &c.

Caulk, pay, and paint all the external seams and timbers; excavate from the dock in which the caisson has been constructed, to the nearest part of the sea-beach; let in the water, and try its buoyancy and trim. Of its buoyancy, from the demonstrations given in the estimate, there can, I think, be no doubt, and its trim may be amended, if necessary, either by iron ballast, or by some weighty antique of value. As the base, or lower half of the obelisk, is much heavier than the upper half, in the proportion that the lower, 25 feet in length, is equal in weight to the upper 39 feet, if about 36 feet is placed before the centre of the caisson in length, and 28 feet aft, the vessel will float well up by the head. But if an experienced seaman should prefer the load or water-line to be level with the obelisk and deck, it should, in that case, be placed 39 feet before, and 25 feet abaft the longitudinal centre. This, however, may be amended to any degree, by placing it a little more or less fore or aft, or by ballasting in the manner before mentioned. The caisson will be 100 feet long from stem to stern, 25 feet broad from out to out, 15 feet deep from the deck to the bottom of the square part of the caisson, and 3 feet 6 inches below that part, by way of bottom and keel. By being immersed the broadway of the transverse section, it will necessarily float higher in the water than by the narrower way. The bottom and keel will increase its sailing qualities more than if entirely flat-bottomed, whilst the broad, flat, under surfaces of the timbers on each side of the obelisk will assist its buoyancy. It may be well to be provided with lee-boards, like the Dutch flat-bottomed craft, or the Humber "Billy-boys."

The vessel being thus far equipped for her voyage to England, she may be named; the master and his crew, with all proper provisions, stores, &c., put on board, she may sail, with God's blessing, from the ancient city of the Pharaohs, to the more modern port of London, dignified from the times of the Cæsars to that of Victoria.

The next process will be for the master and his crew to navigate the caisson and its freight into the Thames, and lay it alongside of, or into the collier dock, near the Victualling-office at Deptford. Then unrig the caisson, take it to pieces, and transfer the obelisk from its bed in the caisson, on to a carriage formed in the following manner:—Link six of the strongest railway goods-trucks together, and form a platform thereon of two transverse beams of the spare timbers from the caisson, 10 feet long, two on each truck, with a longitudinal piece on each side of the obelisk, its entire length, well bolted to all the transverse pieces. This will distribute the weight on the rails to less than seven trucks fully loaded with heavy goods, and one engine, which, together, are about 60 feet long. Then attach an engine to this compound carriage, and convey it along the collier line from Deptford to its junction with the Croydon line at New Cross; thence to the Sydenham station, and thence again by the branch line now in progress, which, I presume, will be finished by the 1st of May, 1853, the time by which, should this proposition be adopted, I hope to accomplish it, to its destination in the Crystal Palace Park. When it is thus deposited, the process of erection is too well known to need any description in these proposals, which terminate in delivering the obelisk in the Crystal Palace Park. The process would be the same, on a larger scale, by which I raised the monolithal granite obelisk, made by the Haytor Granite Company, on its pedestal, at the southern end of Farringdon Street.

The fir timber proposed to be used in the construction of the caisson being, for full five-sixths of its quantity, as good as when first taken over, is, with the used or deteriorated portion, the iron-work, masts, rigging, sails, stores, anchors, chain-cables, equipments, &c., to be sold by tender or by auction, and therefore forms a large deduction from the first cost of the caisson, and the expense of bringing it and the obelisk from Alexandria to Sydenham. My estimate of the cost is this:—

The obelisk, according to the best authorities, is 64 feet long, 8 feet square at the larger end, and 4 feet 3 inches square at the smaller end. Some writers describe it as of smaller dimensions, but none that I am aware of as larger. The above measurement is, therefore, used as the basis whereon the following calculations and estimate are founded.

Being a regular prismoid, or frustrum of a pyramid, the base of which is 8 feet square, the top 4 feet 3 inches square, and the slant height 64 feet; the solidity of the obelisk is found by adding the areas of the bottom and top, and the mean proportional between them together, and multiplying the sum by one-third of the height as follows:—

8′ 0″ × 8′ 0″ = 64′ 0″, the area of the bottom.
4′ 3″ × 4′ 3″ = 18′ 0″, the area of the top.
8′ 0″ × 4′ 3″ = 34′ 0″, the mean proportional between the two.

Therefore 116′ 1″ × 21′ 4″, one-third of the height = 2476′ 5″ 4‴ cube its solidity. The average weight of five species of Egyptian porphyry, the material of this obelisk, being 170 lbs. avoirdupois per cubic feet, it follows that

$$2476' \, 6'' \times 170 \text{ lbs.} = \frac{421005 \text{ lbs.}}{112} = \frac{3765 \text{ cwt. } 101 \text{ lbs.}}{20} = 188 \text{ tons } 7 \text{ cwt. } 101 \text{ lbs.};$$ to which, for the sake of round numbers, and for the pyramidal vertex, is added 1 ton 12 cwt. 11 lbs. = 190 tons, the weight of the obelisk to be brought over.

The next question is, how many cubic feet of yellow fir timber, the specific gravity of which is 700·, will be required to float this obelisk, the common weight of which is 190 tons, and its specific gravity 2723·, in sea-water, whose specific gravity is 1030·?

First, 190 tons × 20 cwt. = 3800 cwt. × 112 lbs. = 425600 lbs. × 16 oz. = 6809600 oz., the weight to be floated.

Then, as 2723 sp. gr. : 680966 oz. : : 1728 cub. in. : 4313984 cub. in. in the obelisk.

And as 1728 cub. in. : 4313984 cub. in. : : 1030 sp. gr. : 2513543 oz., the weight of sea-water equal in bulk to that of the obelisk.

Hence, as 1030 − 700 = 330 : 6809600 − 2513543 = 4296057 : : 1728 : 22498746 cub. in. = 13078 cub. ft. = 261 lds. 18 ft.

Therefore, if 261 loads 18 feet of yellow fir timber will float the obelisk in sea-water, consequently, the caisson herein proposed will contain, exclusive of the space occupied by the obelisk, 603 loads of fir timber, leaving 341 surplus loads, which will float it 8 feet above the water, with the iron-work, rigging, chain-cables, cargo, and stores.

	£	s.	d.
The dry dock, with inclined sides and ends 110 feet average long, 35 feet wide, and 10 feet deep, will be 1425 cubic yards of digging and throwing out, which, by the price of labour in Egypt, may be done for 1s. per yard,	71	5	0
To 603 loads of yellow fir timber, delivered at Alexandria,	2,713	10	0
To 2 masts, bowsprit, rudder and its gear, binnacle, at £4 10s., and compasses, rigging, yards, sails, lee-boards, and tackle, &c., complete, about	350	0	0
To 4326 superficial feet of extra labour to the sheathing, caulking, paying, and painting, at 6d.,	108	0	0
To chain-cables, anchors, and capstan, about	150	0	0
To the bulk-heads for cabins, stores, &c., on deck, about	50	0	0
To about 2 tons wrought-iron work and labour, for bolts, ties, nuts, screws, &c., at £25,	50	0	0
To labour in constructing the caisson, forming the inclined plane, getting the obelisk on board and securing it:—Egyptian labourers, 300 days at 1s. (£15); English labourers, 100 days at 5s. (£25),	40	0	0
To packing and filling up the intervals with raw Egyptian cotton, about	20	0	0
To wages for the master at £10, the mate at £7, and eight seamen at £3 each per month, say 1½ month, at £40,	61	10	0
To 6 weeks' provisions, wine, spirits, tea, &c., for the above, master, mate, and crew, 1½ month, at £20,	30	0	0
To pilotage from the Downs to Deptford, about	15	0	0
To landing the obelisk at Deptford, hire and wear of carriages, locomotive engines, strengthening certain portions of the present railways, from the landing-place to the Crystal Palace Park, about	250	0	0
Carried forward,	£3,909	5	0

Brought forward,		£3,909 5 0
To expenses for the voyage out and home, residence in Egypt, &c., for the engineer and his assistants, and salary for the latter, about		500 0 0
To commission for the engineer in directing and superintending the whole operation, £5 per cent. on £6,000,		300 0 0
To incidental or unforeseen expenses, about		290 15 0
		£5,000 0 0
By 500 loads of undamaged timber, at £3,	£1,500 0 0	
By 100 loads of used and deteriorated timber, at £2,	200 0 0	
By re-sale of the masts, bowsprit, rudder, &c., rigging, sails, iron-work, chain-cables, anchors, cabins, fittings, stores, and cotton, before charged, about	400 0 0	
		2,100 0 0
Net sum, which cannot exceed		£2,900 0 0

This balance might be reduced, by deducting the premium for insurance, which in this case is unnecessary.

JAMES ELMES.

Holmesdale, *Lewisham*, *December*, 1852.

ON A NEW FORM OF SCREW-PROPELLER.*

I stated last month that the new propeller possessed three several properties; the first being the taking up such a position when not in use, as to cause no impediment to the ship's sailing progress. This is considered necessary on the assumption, that at certain times, as when there is a favourable breeze, the propeller does not cause an increase of speed equivalent to the cost of working it. It is a prevalent opinion, however, on the other hand, that as far at least as concerns the merchant navy, it is better to keep the propeller always in action; and, in fact, the arrangement alluded to is only of any value for vessels of war, where economy of fuel is wanted rather than speed, or in case of accidents necessitating a stoppage of the engines, such as running short of coals, as occurred to the *Great Britain* on her voyage to the Cape; but it would generally be considered preferable to run the risk of such accidents, rather than adopt any preventive arrangement involving complication, and possibly liability to more serious accidents than those it professed to avert.

If, with an ordinary invariable screw, it is expedient to keep the engines constantly going, it must be much more so with one capable of accommodating itself to circumstances—with one, indeed, which will give the full additional effect due to the engine power employed, however favourable and strong the wind may be. Where, then, the second property exists—namely, that of accommodation to circumstances—the first is rendered unnecessary, or nearly so. With this view, a contrivance was sought for obtaining the second property only, the first being quite overlooked as of no moment; but it so happened that the identical arrangement hit upon to effect the alteration of pitch, provided without any further addition for the fulfilment of the other condition. It has been shown, that as the wind power increases, so should the pitch of the screw; the pitch depending on the proportion between the velocity of the screw and the sailing speed, where the latter exists: if the latter be infinitely great in proportion to the former, the pitch must be infinitely great; that is, if the velocity of the screw be infinitely small, as compared to the sailing speed, the pitch must be infinitely great; and further, if the velocity of the screw be *nil*, the blade must lie in the plane of the axis. It is thus evident, that the two first conditions differ but in degree, and that an arrangement which answers for the second, must, as a necessary consequence, fulfil the first.

The question under consideration is one of some difficulty. A screw is wanted which shall vary in pitch, but the extent of surface must vary also. A rigid metallic blade has this defect, that if shaped so as to form a portion of a true screw in one position, it will not do so in another. We want a flexible and an elastic blade, and to obtain this we must have recourse to a material which has already proved itself a most valuable assistant to the mechanic and artificer—vulcanized india-rubber.

Figs. 1 and 2 of the engravings, are end and side elevations of the new propeller, representing it in a state of rest, its blades being in the form of planes, lying entirely within the dead-wood. Figs. 3 and 4 are corresponding views, showing the shape assumed when the propeller is in action. Figs. 5, 6, 7, and 8, show the instrument with the india-rubber removed; they are counterparts of the four first figures. A true helix may be described as being generated by a straight line at right angles to an axis, round which it moves, having, at the same time, a longitudinal traverse. The section of a helix, at right angles to the axis, is always the radius of a circle, of which the axis is the centre. If we take half a dozen Congreve matches, and, running a pin through their longitudinal centres, spread them out like a fan, we shall have the skeleton of a screw of two threads, similar, in appearance, to figs. 7 and 8. According as we vary the angular distance between the matches, so do we vary the pitch of the screw. The more they are spread out, the finer is the pitch, and *vice versa*. The screw is formed by a series of steel or wrought-iron rods, A, B, fig. 6, through the centres of which passes the shaft, C. The skeleton thus formed is covered with vulcanized india-rubber; the thickness of this material being so varied as to make that of the entire blade as uniform as possible, whilst it is attached to the shaft by means of the caps, D. The rods, A, B, are loose on the shaft, but they cannot traverse longitudinally upon it. When the blades are disposed as in figs. 1, 2, 5, and 6, the india-rubber is quite loose, or not stretched.

If the end, A, of the blade be fixed to the shaft, the latter being caused to revolve in the water—in the direction, say, of the arrow—the fluid resistance will cause the other end, B, and the intermediate portion, to turn or twist round the shaft, until the tension, called into play by the stretching of the india-rubber, shall balance it. The propeller will thus assume the shape of the screw represented in figs. 3 and 4, propelling the vessel in the direction, B—A. The strength and elasticity of the india-rubber must be so proportioned, as that the action of the water shall cause the blades to assume the form of best effect. If the resistance increases, the after-part of the blades will twist further round the shaft, until a sufficient tension is caused by the increased stretching; in other words, the screw will assume a finer pitch, and have an increased surface. If, on the other hand, the resistance diminishes—that is, if the ship is assisted by the wind—the elasticity of the blade will enable it to recover itself, and assume a greater pitch.

So far, so good; but next arises a great difficulty. It was before stated, that if the after-part of the blade be flexible, or yield, the screw would propel the vessel ahead whichever way the shaft turned. As long as the end, A, is fixed, the ship will be propelled in the direction, B—A, whether the shaft turns in the direction of the arrow, or the reverse. To enable the ship to back, some means must be employed to release the end, A, from, and fix the end, B, to the shaft; but here is the difficulty. How is it to be done, without employing the description of setting gear denounced last month? Some means of simplifying such gear was sought for in vain, and the propeller was for some time laid aside as an abortive scheme. The fortunate idea then occurred, that though it was immaterial which way the shaft turned, supposing one end, as A, of the blade were fixed to it, yet a contrivance might possibly be discovered, enabling the shaft itself to fix one, and only one end, A, of the blade, when turning in one direction, and the other, B, when turning the reverse way.

A reference to fig. 9, representing on a larger scale the contrivance adopted, will render it at once intelligible. On the shaft, C, close up to the exterior rod, A, are two projections opposite to each other; on the rod itself there are two corresponding projections. On the other exterior rod, B, that is, at the other end of the series, there are similar projections, which, when the rods are in a line, are directly behind the projections on the rod, A. There are also projections on the shaft, close up to the after rod, B, but so placed, as indicated by dotted lines in fig. 9, that when the rods are in a line, the fore and after shaft-projections shall be on the opposite sides of the rod-projections.

If the shaft turns in the direction of the arrow, the fore-end projections will fix, and carry round the rod, A; and the resistance of the water will turn the after rods round on the shaft, since the after shaft-projections are not in a position to prevent it; but turn the shaft in the other direction, and the resistance of the water will bring up the after rod, B, against the after shaft-projection, whilst it will carry round the fore rod, A, the fore shaft-projection not being now in the way. By this simple means the propeller is enabled to back, or go ahead, in precisely the same manner as a rigid screw—namely, by merely altering the direction of rotation.

The india-rubber of course covers all these parts, and thereby prevents corrosion from interfering with their action; but that part of it which envelopes the shaft must be very loose, to allow of the blades twisting round as far as is necessary.

The self-acting contrivance is also applicable to rigid-bladed propellers, such as Buchanan's, Woodcroft's, Hay's, Maudslay's, and Griffith's.

The propeller may be simplified by employing only two rods, if these can be made strong enough without being too bulky; and the intermediate web will not bag much, as might be apprehended—for the after rod will yield as much as any part of the web. A slight bagging, indeed, will be no detriment, for it will constitute an increasing pitch, which is deemed beneficial; and it will have this advantage, that, whereas a rigid screw of increasing pitch becomes one of decreasing pitch when backing, the flexible screw will have an increasing pitch under all circumstances. Instead of the shaft passing through the centres of the rods, the rods may pass through an enlarged boss on the shaft, as in fig. 10, where two rods are shown, sectioned close up to the boss. Slots are so formed in the boss as to permit the after rod to yield round when the shaft turns in

* Concluded from page 261.

one direction, and the fore when it turns in another, and these slots may also be curved.

In figs. 11 and 12 is shown the method of adapting the self-acting arrangement for backing, to propellers with rigid metallic blades. Fig. 11 is a plan showing the shank of the uppermost blade in section, and fig. 12 is a section through *a*—*b*, in fig. 11. The inner ends of the blade shanks are hemispherical, and fit accurately in a spherical boss, forming an universal joint; and the shanks pass through two slots in the boss, these slots being opposite to each other, and at right angles to the shaft. On the outside of the boss are the projections, A, B; these are disposed exactly as described in reference to previous modifications. The dotted lines indicate the edges of the blade on either side of the shank, which fit close to the boss. The blade is supposed to be lying in a plane passing through the shaft, and the shank is consequently in the centre of the slot. The action will be as follows: Supposing the shaft to be revolving in the direction, A—B, the resistance of the water will force the blade in

Fig. 1.

Fig. 2.

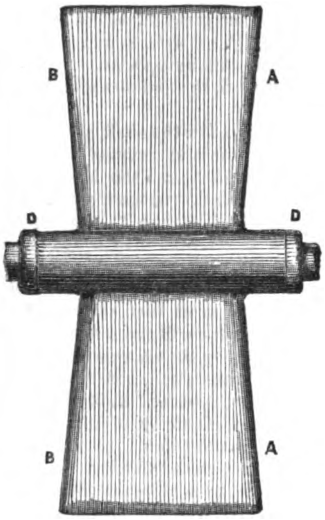


Fig. 3.

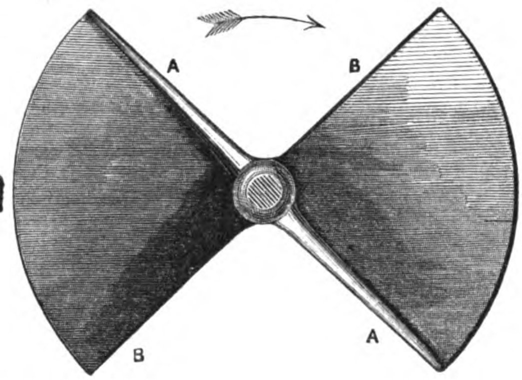


Fig. 4.

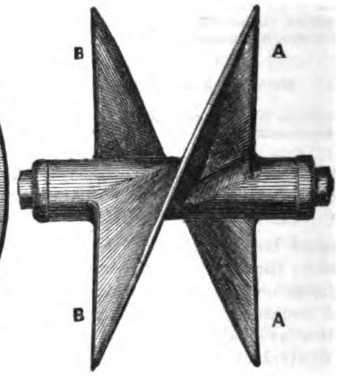


Fig. 5.

Fig. 6.

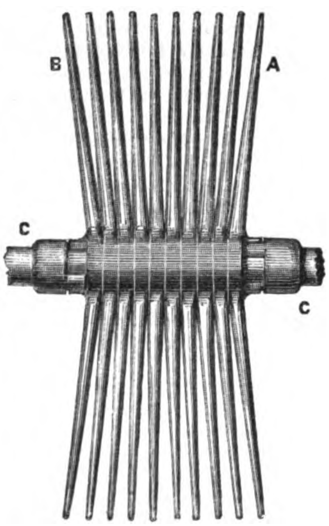


Fig. 7.

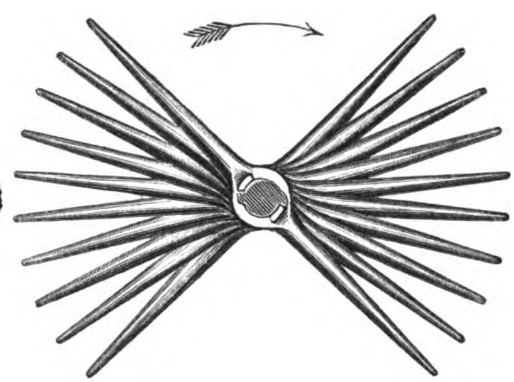


Fig. 8.

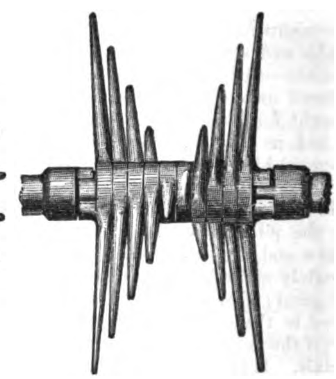


Fig. 9.

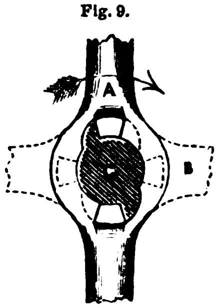


Fig. 10.

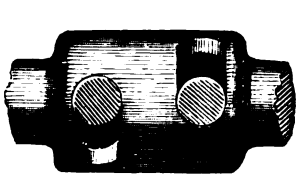


Fig. 11.

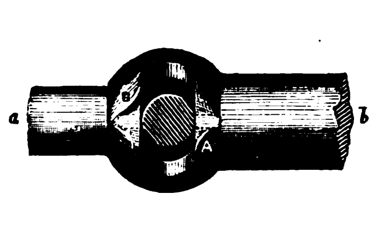
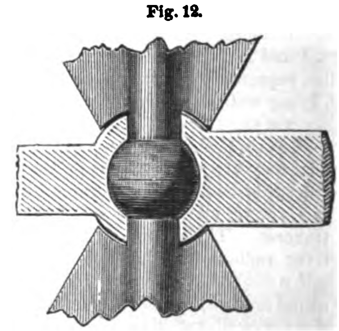
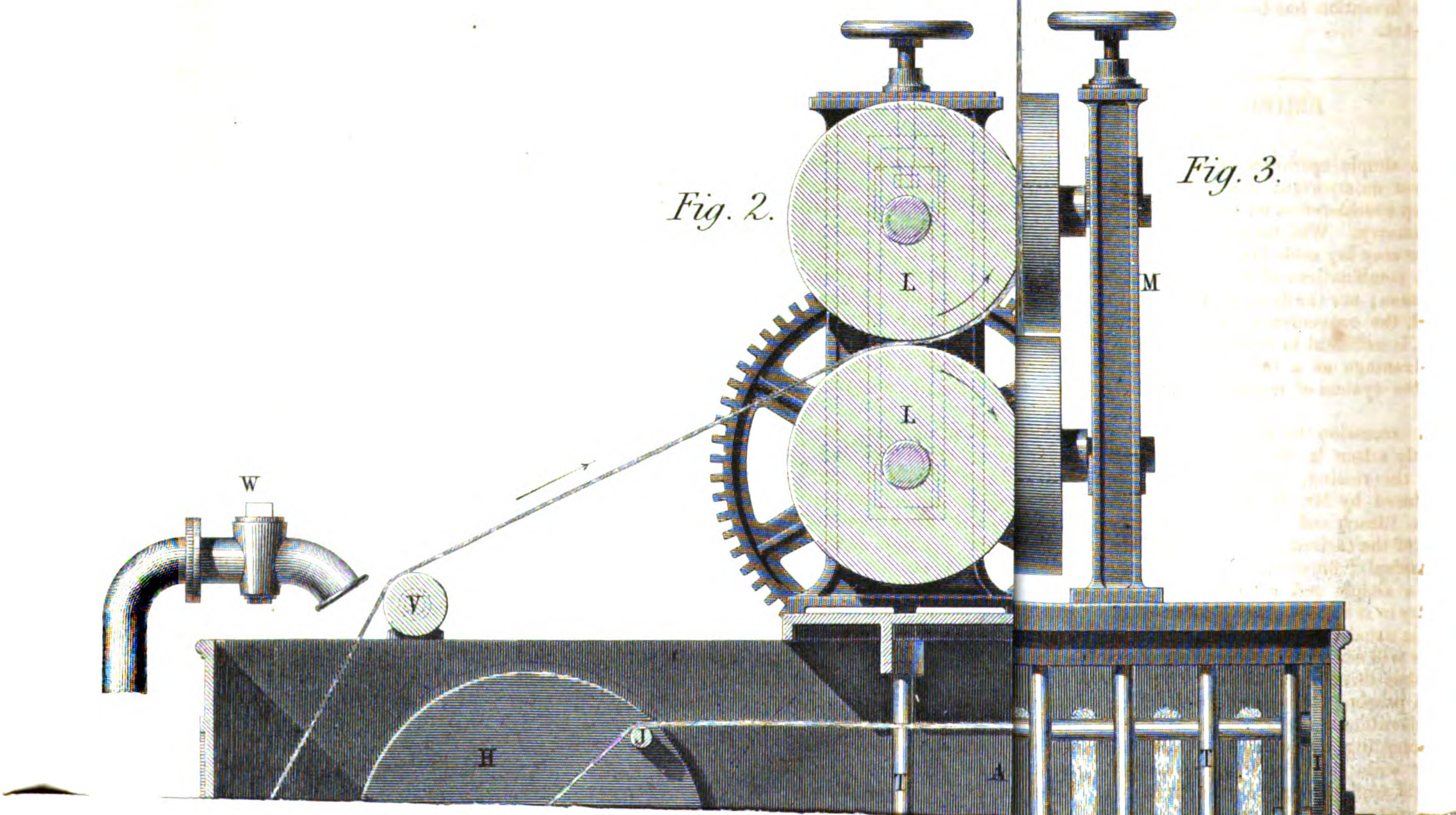


Fig. 12.



WASHING MACHINE ABRICS.

H. BRIDSON, PATENTEE, RS.



in the direction, B—A, making the shank traverse the slot. The projection, A, however, will prevent the fore-edge of the blade from yielding to the water, whilst the after-edge is at liberty to do so; and the blade will consequently turn on its shank, and assume the angle that the proportions are calculated for. If, on the contrary, the shaft revolves in the direction, B—A, the projection, B, will prevent the after-edge of the blade from yielding to the now reversed resistance, whilst the other edge will give way. The shanks have thus to turn on their own axis, and also on that of the shaft, and are enabled to do so by being formed with an universal joint, as described. The opposite blades require to turn on their common axis in different directions, otherwise they might be made in one piece.

This last modification may be rendered still more perfect by the addition, in the inner ball, of a strong coiled spring fixed to each shank. This will enable the blades to assume a varying obliquity, according to circumstances; for, as they turn in opposite directions, the tension of the spring will regulate the extent, and, when necessary, its elasticity will cause them to recover their normal position. The boss should be enveloped in vulcanized india-rubber, which must be attached to the central part of the blades; this will prevent the corrosive effects of salt water, and at the same time serve to retain lubricating matter.

Another modification is obtained by forming the propeller of a series of rods, as first described; but these rods flatten and expand, towards their extremities, into thin flexible steel blades, in which case a thinner covering of india-rubber will suffice.

The invention has been duly secured under the Patent Law Amendment Act.

EDMUND HUNT.

BRIDSON'S WASHING MACHINE.

(*Illustrated by Plate* 119.)

The simple operation of washing and cleansing textile materials, however unimportant it may appear as an abstract process, is a matter of deep consideration for the proprietors of the colossal manufactories of this country. Without an economical system of purification, the calico-printer may lay aside his hopes of excelling in the beauty and sharpness of his combinations of colour; the bleacher need not attempt a finished whiteness; nor the dyer, a brilliancy of tints. In all such undertakings, indeed, the convenience, or the reverse, of a plentiful supply of pure water, is sufficient to determine the site of the works; and next to such an advantage as a full, pellucid, and chemically valuable stream, an effective system of mechanical washing is the next item of consideration.

An accession to this branch of manufacturing mechanism has recently arisen in the patented "improvements in machinery, to facilitate the rinsing, washing, and cleansing of fabrics," invented and introduced by Mr. H. Bridson, of Bolton-le-Moors, Lancashire, at the Bolton Bleach and Dye Works—an establishment well known as the scene of the earliest, and, even now, the most important principle of the mechanical "finishing" of piece goods. Mr. Bridson's invention is at once a simple and most efficient contrivance, the essential point of novelty in it being the substitution of flat "winces," or revolving frames, for the usual rollers of cylindrical or polygonal section. The practical reader will see what we mean on examining our Plate 119. This plate furnishes three several views of the apparatus as in working order, with goods passing through for the washing operation. Fig. 1 is a perspective elevation of the washer complete, showing the whole of the gearing for actuating the moving details; fig. 2 is a longitudinal section on a larger scale; and fig. 3 is a corresponding transverse section—that is, at right angles to fig. 2. The main body of the machine consists of an open rectangular cistern, A, of cast-iron, which is kept about half full of the cleansing water. A couple of horizontal transverse shafts, B, C, are passed through this cistern, being carried in bearings in the two opposite side plates, and projecting through on one side to carry the spur-wheels, D, E. These shafts are made to revolve in the same direction by the revolution of the intermediate driving shaft, F, carrying a third spur-wheel, G, in gear with the other two. The two shafts, B, C, have each a pair of end discs, H, I, fast upon them, to hold the diametrically opposed parallel rail bars, J, which form the flat winces or revolving frames, for acting upon the goods in the washing movement; these details, indeed, constitute the whole of the action.

The same central wheel, G, also drives an overhead wheel, K, of similar size, for actuating squeezing rollers, L. These rollers are of large diameter and of considerable breadth, and are set in bearings in the pair of vertical standards, M, carried on a cross bar on the top of the cistern, on which also is a low standard, N, for the bearing of the overhanging end of the bottom roller driving shaft. The bearings of this bottom roller are fixed; but those of the upper one are adjustable in the central vertical slots of their standards, by means of screws and hand-wheels at the top, to give any required pressure to the issuing goods.

In erecting the machine for work, the shafts and rails of the washing movement are set in one plane, and the water-level is adjusted to the line of the shaft centres. The fabric to be cleansed is then fed in at one end, O, of the cistern, where two lengths are represented as being entered. Here it descends beneath a fixed guide-roller, P, and thence passes between the pair of nipping-rollers, Q, set in bearings on the side of a division piece, R, and adjustable by hand-wheels and screws. After leaving these rollers, the course of the goods is again downwards, beneath the fixed guide-roller, S, and thence between the first pair of vertical guide-bars, T. The direction is then round the under side of the flat wince at the opposite end of the cistern, the fabric being turned back over the bars, J. It then returns towards the front end of the cistern, and is similarly passed round the bars, J, of the disc, I, from the upper side—this return course being through the second pair or space of the division bars, T. The fabric finally returns through the third guide-space, and in contact with the wince-bars, and is then passed up beneath the guide-roller, U, set at the water-level at the delivering end. From this point, it passes over the top of the external guide-roller, V, and is finally delivered through the squeezing-rollers, L. As there are two lines of goods shown under treatment, it is obvious that both follow the same course.

The peculiarity of this plan is, that as the winces revolve, the opposite strands or lengths in the cistern are constantly flapping against each other and against the fluid surface, as they pass along from the entrance to the discharging end. This action is obvious from the arrangement of the winces in the drawings; for whilst at one period of revolution—when the set of winces and their shafts are all in one horizontal plane—the passing lines of the fabric are in absolute contact, at the end of a quarter turn of the winces, they are sundered to the diametrical extent of each pair of wince-bars. This flapping action has a most important effect upon the cleansing process, inasmuch as it tends to clear off the impurities of the goods by the powerful shake which it imparts; whilst it also facilitates saturation, when the apparatus is employed in any other of the processes of bleaching, dyeing, or printing. Another novelty is also to be found in the arrangement of the apparatus, so as to cause the cloth to strike against the water in a line parallel with the fluid surface; and as the water is just up to the level of the shaft centres, it is clear that the upper strands will come down on the fluid surface with very considerable energy, whilst those strands, or lengths, which are below the water-line, are at the same time violently agitated and rinsed. And as the strands emerge from the water at each dip, with a simultaneous opening action to their greatest width, they lift a great quantity of the water with them, thus getting what the bleacher terms a complete "swill," having the effect of opening the folds, and preparing fresh surfaces for this severe dashing.

Pure water is constantly supplied to the cistern from the pipe, W, the flow being directed upon the emerging fabric, just as it passes up for the last time on its way to the squeezers, so that any floating impurities that might be carried up on the cloth are thus washed clear off. And this is more especially the case, since the folds leave the water in an extremely open state, quite free from twist. The point of discharge of the foul water is immaterial, as the clean water becomes mixed with the great body of the fluid immediately on entering; but in our plate, the impure flow is supposed to be on a level with the centres of the several shafts in the cistern, or through the bottom pipe, X.

The wider the revolving frames are made, the greater will be the flapping and agitation of the cloth, and the machine may be driven proportionally slower for an equal delivery.

In treating heavy goods by this machine, it may be desirable, in practice, to introduce a series of rails or rollers in the same plane as the axes of the winces, to increase the flapping effect; and the machine may be modified by using cylindrical or polygonal rollers set eccentrically on their axis, instead of the revolving frames. Other minor modifications have also been tried, but all of them depend intrinsically upon the peculiar and constantly varying or differential diagonal flapping action of the goods. The last guide-roller, C, too, has been fitted in a slot instead of in fixed bearings, the necessary tension being kept on the fabric by the spring action of an india-rubber spring at each end of the shaft. This is a very valuable and necessary part of the apparatus, as taking off the "drag" or drawing of the squeezing rollers, L, as well as that tension of the cloth which arises only between the guide-roller, U, and the squeezing rollers, L, and compensating for any irregular delivery when the fabric leaves the water at U.

The nipping-rollers, Q, regulate the tension of the cloth, as the tendency of the machine is to slacken the tensional strain in passing

through. This mode of regulation is indispensable where light and heavy goods are operated upon in the same machine.

This system of washing has been in use for some time at Messrs. Ridgway, Bridson, & Co.'s Works, where a lengthened practical test has shown, that whilst the heaviest cloth is thoroughly washed, the most delicate muslins and other light and flimsy fabrics pass through the same ordeal without any fraying or objectionable deterioration. The machine certainly promises to be a most valuable adjunct to all the varieties of works where textile goods are passed through fluids, for whilst it is admirably suited for the bleacher's purposes, it is also equal to the heaviest work of the printer. Any diver who has ever mischanced to fall flat on the surface of the water, instead of plunging in head foremost, can give us vivid evidence of the smartness of the blow he receives. It is exactly this blow which the revolution of Mr. Bridson's winces gives to the goods in this machine. No one can have any idea of the severity of this beating action on the fluid surface, until they begin to consider that a flat parallel blow on water is like a stroke on a board.

It is precisely by such practical inventions as this—the thoughtful result of a practical man's consideration—that our staple manufactures gather up their stages of improvement. Thus it is that manufacturing processes are cheapened, and, by being cheapened, their mechanism of action becomes more widely diffused; and thus mankind are benefited by the continued abstraction of that laborious drudgery which "confines the intellect, and enslaves the soul."

OUTLINES OF GEOLOGY.

V.

SECONDARY EPOCH.

The following is a tabular view of the rocks of the secondary epoch:—

British Beds.	Foreign Equivalents.
Cretaceous System.	
Upper Series—	
1. Chalk with flints.	Scaglia limestones of the Mediterranean.
2. Chalk without flints.	Maestricht beds. Senonian beds, according to D'Orbigny (craie blanche.)
3. Chalk and chalk marl.	Turonian beds of D'Orbigny (craie surface.) Quadersandstein of Germany.
4. Upper green sand.	Albian beds of D'Orbigny.
5. Gault.	Plänerkalk of Germany.
Lower Series—	
1. Lower green sand.	Neacomian of Switzerland and France.
a Kentish rag.	Hilsthon of Germany.
b Atherfield clay.	Pondicherry beds.
? Speeton clay.	Bogota beds, South America.
	? Aptian beds of D'Orbigny.
	? Hilsthon conglomerate of Germany.
Wealden System.	
1. Weald clay.	Near Boulogne.
2. Hastings sand.	North of Germany.
3. Purbeck beds.	
Oolitic System.	
Upper Series—	
1. Portland stone.	Jura limestone.
a Limestones, with clay and cherty beds.	Lithographic limestone of Blangy (Normandy.)
b Siliceous sand.	Honfleur clays.
	Solenhofen beds.
2. Kimmeridge beds.	Beds in South of Russia and in India.
Middle Series—	
1. Coral rag and calcareous grits.	
2. Oxford clay.	Nerinœan limestone (Jura.)
a Stiff clay.	Argile de Dives.
b Kelloway's rock.	
Lower Series—	
1. Cornbrash.	Bathonian beds of D'Orbigny.
2. Forest marble.	
3. Bradford clay.	Calcaire à polypiers.
4. Great oolite.	Calcaire de Caen.
5. Stonesfield slate.	
6. Fuller's earth.	
7. Inferior oolite.	
Liassic System.	
1. Upper Lias, or alum shales.	
2. Marlstone.	
3. Lower lias.	Calcaire à gryphites.
4. White lias.	
Triassic, or Upper New Red Sandstone System.	
1. Variegated marls, with salt and gypsum.	1. Keuper marls, or Marnes irisées.
	2. Muschelkalk.
3. Variegated sandstones.	3. Buntersandstein, or grès bigarré.

The name *Triassic*, given to the lowest of the systems above tabulated, is derived from the three divisions of which it consists on the continent. Equivalents of the first and third only have been found in England, and these are not easily distinguishable from each other. In Germany, a limestone deposit, called muschelkalk, separates the upper arenaceous beds, there termed keuper, from the lower arenaceous beds, or bunter sandstein. The English sandstones contain very few fossils; but there is a thin dark marly bed, first found at Austcliff, on the left bank of the Severn, which contains so many fossil remains, principally of fishes, that it is known as the bone bed. At that locality it lies immediately under the lias, with which system it was formerly classed, but its fossils prove it to belong either to the keuper or muschelkalk. This bed was afterwards traced to places more than a hundred miles from Austcliff, but it is seldom more than two or three inches in thickness.

The Triassic beds in England are remarkable for the variegated character of the sandstones and marls of which they are composed. They are widely spread throughout the midland counties of England, whence three branches proceed—one to the north-east and north, forming a long narrow band, ranging between the town of Nottingham and the sea-coast south of Sunderland; a second, almost in a line with the first, but proceeding in a south-westerly direction to the south coast of Devonshire; and a third, a much broader and also shorter limb, which occupies the northern part of Shropshire and the whole of Cheshire. A narrow band of the same crosses the Mersey, and connects Liverpool with Lancaster, where it is quarried as building stone. The highest point of this large area (Barr Beacon, in Staffordshire) is only 800 feet above the sea.

The lowest part of the series occurs in the midland counties, and consists of sandstone. In some places this is succeeded by conglomerates, composed of fragments of the rocks of older periods. The upper part of the series is remarkable for the abundance of edible salt which it contains. Springs of water, richly impregnated with salt, are especially plentiful in Cheshire, and rock-salt also occurs there. The total thickness of the rock-salt of Northwich is reckoned at 60 feet. The beds extend laterally 1½ mile. It occurs alternating with gypsum, with numerous variegated beds of clay, and with red sandstones. These, and other beds of salt which occur in the midland counties, are supposed to have been deposited from sea-water, which may have existed as lagunes. The brine springs contain iodine and bromine.

Besides the localities above mentioned, the new red sandstone occupies a broad plain between the Cumberland mountains and Solway Firth. In Ireland it occurs to a small extent in the neighbourhood of Belfast. Slight traces appear in Scotland. The remains of reptiles found in the Triassic deposits indicate that a greater variety of forms then existed than during the previous period. The families Chelonia, Batrachia, Lacertilia, and Enaliosauria had representatives. Six species of an enormous frog, the Labyrinthodon, have been described. Cladyodon and Rhyncosaurus are other peculiar reptilious genera. In Scotland and Cheshire, footprints of Testudo and Emys have been noticed. The fishes consist of sixteen species of the Placoid and seven of the Ganoid divisions. On the whole, this system is but sparingly supplied with fossil remains in England. The muschelkalk of Germany, however, abounds with remains of fishes, radiated animals, and shells. This bed, in the north of Bavaria, usually consists of a grey limestone; in Wurtemberg it is a yellowish limestone, containing rock-salt, and alternating with bands of gypsum; at other places it is bituminous, giving out a fetid smell when rubbed.*

Liassic System.—The paucity of sandstones is one of the peculiarities of this system, and distinguishes it from that immediately below it. It consists for the most part of alternate bands of tolerably hard limestone and soft shale. A blue or bluish-grey colour pervades the strata, especially in the upper part of the series, as may be conspicuously seen at Lyme-Regis, Whitby, and Barrow-upon-Soar (Leicestershire).

The lias forms an almost continuous band from the sea at Lyme-Regis (Dorsetshire) to the coast of Yorkshire. Throughout this long range it is interrupted only by the Mendip Hills (carboniferous limestone) in the southern, and the marsh land at the mouth of the Humber in the northern part. It generally forms broad and level plains at the foot of the oolitic hills, but on the borders of Nottinghamshire and Leicestershire rises into a range of low hills (Wold Hills). The lower and middle beds occur principally in the middle, and the upper beds at the two ends, of the range. At Whitby (Yorkshire) the strata consist of shales, enclosing carbon in the form of *jet*, and also large fragments of bituminized wood. The lime obtained from some of the lias beds possesses the valuable property of hardening under water. The Lias system occurs in some of the islands of Scotland and in Antrim (Ireland).

This system is contrasted with the preceding by the abundance of its fossil remains, particularly of Saurian reptiles. Nine species of Ichthyosaurus and eleven of Plesiosaurus have been discovered—the genus Plesiosaurus and that of Belemnite being found in it for the first time. The Ichthyosaurus has been described as combining the snout of a porpoise with the teeth of a crocodile, the head of a lizard with the vertebræ of a fish, and the sternum of an Ornithorhynchus with the paddles of a whale. In general outline, the Ichthyosaurus is supposed to have most nearly resembled the porpoise and grampus of the present seas. It pos-

* Certain fossil bones discovered in the Wurtemberg formation have been recently determined by M. Jager to be those of a marsupial animal. We are not aware whether his opinion has been confirmed by any English authority.

sessed, like a lizard, four organs of locomotion, but they resembled the paddles of the whale. It was assisted also in its movements by a long and powerful tail.

The genus Plesiosaurus is distinguished by the extraordinary length of the neck. In the P. Dolichodeirus, the neck is as long as the body and tail, and has more vertebræ than the swan's neck. This genus is of a smaller size than the preceding, and its tail was comparatively short. Some species must have attained thirty feet in length, others did not exceed ten feet. Another most remarkable reptile, the Pterodactyle, occurs in the lias. Many species of this genus have been discovered in the Liassic and Oolitic periods, varying from the size of a snipe to that of a cormorant. It was for some time a matter of discussion among naturalists whether these creatures were birds, bats, or flying reptiles; but they are now admitted to have been reptiles. They differed from birds especially in the head, which was elongated like the snout of a crocodile, and armed with conical teeth. The skeleton again distinguished it from the mammal bat. Remains of fish occur plentifully in the liassic rocks; sixty species have been described belonging to the Placoid and Ganoid divisions. Mollusca are also abundant; Ammonites are especially so, and Belemnites, Pentacrinites, and the remains of cuttle fishes are common. Star fishes are also frequent in some of the deposits. The Lias system is developed in Wurtemberg, Belgium, and other parts of the continent, where the lower beds are generally more sandy than in England, and pass gradually into the sandstone of the Triassic system.

Oolitic System.—This system may be generally described almost in the words applied to the Liassic system, which, according to some geologists, forms part of it. The oolitic strata follow the same direction as the lias, forming a band external to it, from the Dorsetshire coast to the Yorkshire coast; at some points, however, disappearing, and at others widening out. The limestone part of this system forms three ridges, with intervening plains occupied by the clays and shales. The limestone of the lower beds generally forms an escarpment over the lias, while the upper clay beds are overlaid by the lower green sand of the next system. The different members of the lower group of the oolitic series are for the most part only of local interest. The well-known Bath building stone comes from the great oolite, and building stone of an inferior quality is extracted from other members of the series. The well-known Caen stone is the French equivalent of the Bath oolite. Organic remains of the sub-kingdoms, radiata and mollusca, are abundant in this part of the oolitic series. Fish also occur, and reptiles of the genera already described, to which some new genera are added. The earliest specimens of megalosaurus occur in the Stonesfield slate (Oxfordshire). The creature to which the bones of the Stonesfield slate belonged is supposed to have measured from forty to fifty feet in length, and to have resembled in structure the crocodile and monitor among existing reptiles. It differed from the Saurian reptiles described above, in its limbs, which resembled those of the larger quadrupeds.

The Stonesfield slate is celebrated as being the earliest rock in Britain which yields remains of mammalia. These consist in jaw-bones of three marsupial animals of small size (probably not exceeding that of a mole). The names they have received are Amphitherium Broderipii, Amphitherium Prevostii, and Phascolotherium Bucklandi. No other remains of mammals have yet been discovered prior to the tertiary epoch. The Amphitheria are supposed to have been insectivorous, and it is curious that the wing-covers of coleoptorous insects have been discovered in the same rock. The middle oolitic group consists generally of the Oxford clay (at the bottom), succeeded by the coral rag, which is supposed to have formerly existed as a coral reef. The Oxford clay is a bed of great thickness, and widely distributed. The fen districts of Cambridge and Lincoln consist of Oxford clay and Kimmeridge clay. The Oxford clay occurs also at Weymouth, and covers a large area in the East Riding of Yorkshire. It is a stiff pale-blue clay, containing a large proportion of calcareous matter, intermixed with iron pyrites. In some places, Kelloway's rock, a thin bed of calcareous sandstone, underlies the Oxford clay. The coral rag is best seen in Wiltshire. It is about forty feet in thickness, and large portions of it consist of a single species of coral. Above the coral rag occur beds of calcareous freestone and ferruginous sandstone.

The organic remains of the middle oolite are numerous; they belong chiefly to the radiata and mollusca divisions.

The upper oolite, which is nearly confined to the south of England, consists in the lowest part of a blue slaty, or greyish yellow clay of great thickness, but not very extensive, called Kimmeridge clay. Alternating with this clay are beds of a highly bituminous shale, sometimes used as fuel. Similar beds, but affording fuel of a better quality, occur in the lowest oolitic beds in Yorkshire. In America (State of Virginia) an extensive bed of good bituminous coal occurs of the same age.

Next above Kimmeridge clay occur beds of coarse earthy limestone, resting on a bed of siliceous sand. Above these occur beds of Portland stone, interstratified with clayey and siliceous bands. The Portland stone affords an excellent building stone. In this part of the series appears a bed about a foot in thickness, of a dark earthy character, called the Portland "dirt-bed." In this bed are found the trunks of fossilized cicadeæ, and also the roots and portions of the stems of coniferous trees, apparently in the position they occupied when living. The celebrated lithographic stone of Solenhofer (Bavaria) is obtained from a very fine-grained limestone belonging to the upper oolite. This formation contains also the remains of many Saurian reptiles. The genera Pliosaurus and Steneosaurus are peculiar to the Kimmeridge clay. Chelonian reptiles also occur. Several kinds of ammonites are also peculiar to this part of the series.

In Scotland, rocks appear in some places which are referred to the middle part of the oolite system.

The Wealden System is found in one locality only in England, occupying a continuous area of low elevation in the counties of Surrey, Sussex, and Kent. Its position will be better understood when we have described the Cretaceous system which lies above and surrounds it. With the exception of the lowest beds, it is of fresh-water origin, indicating the existence of a vast lake, to which the sea occasionally obtained access, or of an estuary into which a great river flowed. The lowest beds are the Purbeck beds, which consist, at the bottom, of limestones associated with clay, one of the beds being composed almost entirely of oyster shells. The higher beds consist chiefly of remains of a univalve shell (Paludina), cemented by carbonate of lime and green matter. The next series of beds is known as the Hastings sand. These beds consist of various sands and clays, the former being sometimes highly ferruginous. The highest beds of the Wealden, called Weald clay, consist of a limestone chiefly made up of fossil Paludinæ, and known as "Sussex marble," alternating with clays and sandstones.

The organic remains of the Wealden system consist of numerous reptiles, fish, and lower forms of animal life, and also of plants. They are all of estuary, or fresh-water, or terrestrial forms. Many new genera of Saurian reptiles make their appearance. The most remarkable is the Iguanodon, which bears a very close resemblance to the modern Iguana; but while this does not exceed five feet in length, the Iguanodon is supposed to have attained the enormous length of seventy feet, the greatest part of which, however, belonged to its tail. The Iguanodon, like the Iguana, was probably an herbivorous animal. Species of the tortoise and turtle tribe also occur. Fishes are found belonging to the Placoid and Ganoid divisions.

Beds contemporaneous with the Wealden deposits have been traced to some extent in Scotland. In France, fresh-water beds of the Wealden age (Boulogne, Beauvais) are found separated by marine beds of the age of the green sand of the Cretaceous system.

SMITH'S SELF-ACTING LUBRICATORS.

The three automatic lubricators, of which the annexed figures represent partial sectional views, are the invention of Mr. Charles Smith, of London. They combine the old principle of capillary attraction with mechanical actions for the regulation of the oleaginous flow, and the adjustment of the quantity delivered, as circumstances require. The modification shown in fig. 1 is suitable for ordinary shafting, a cut or projection on the shaft being made to act, at each revolution, upon the lower extremity of the projecting spindle, A, which works loosely through a guide-eye in the bottom of the lubricator. Thus, at each revolution of the shaft, this spindle rises and falls, and gives a corresponding action to the loosely-hung tubular piece, B, which oscillates on a fixed stud centre, C. The oil is in the cylindrical brass reservoir, D, the flow downwards being through the passage, E, guarded by a clack-valve, the weighted spindle of which keeps the aperture closed, until the reservoir is adjusted upon the lower case, as at the joint, F, when the valve is opened by the contact of the extremity of the spindle with the bottom of the case. The oil thus finds its way down into the lower case, and the free end of the tubular piece, B, dips into this oil at each oscillation. This piece, B, is filled with some loose fibres of wool, so that the capillary attraction comes into play at each movement; and the oil taken up in these minute quantities passes along the tube to the other end, where it is discharged, drop by drop, into the small open division, G, whence it finds its way down between the guide and the spindle, A, to the bearing to be lubricated. The quantity of oil taken up at each movement, and passed over, is determined by the set-screw, H, by means of which any required compression may be exerted upon the woollen fibres.

Fig. 2 is the same apparatus very slightly modified. The action is obtained from the pendulum, A; each vibration of which, from any passing pin, causes the capillary tube, B, to vibrate, as before described; the

spindle to which the pendulum is hung having a small cam piece, C, upon it, to work upon the end of the tubular piece. The oil flows off by the central passage, D. In fig. 3, the flow is put on or off by the tumbler lever, A, fast on a jointed tubular piece, B, which contains woollen fibres, extending through it into a fixed tube, C. As we have represented it, the oil passes up in a regular continuous flow from the bottom of the case, a set-screw being provided to increase or diminish this supply at pleasure. But if the attendant wishes to cut off the supply, he throws the tumbler over to the other side, and this action brings the extremity of the wool in the piece, B, out of the oil, and suspends the capillary lift. As thus arranged, this particular form is obviously not self-acting; but it would be an easy matter to make it so. All the three kinds are

Fig. 1.

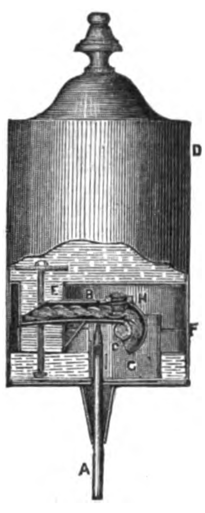
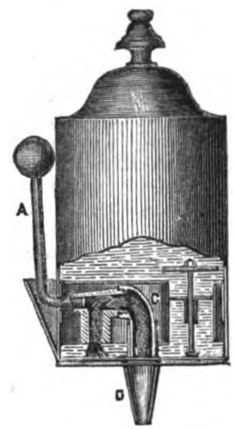


Fig. 2.

Fig. 3.



fitted with bottom slide pieces, for adjustment upon fixed suspending slips, to hold the apparatus in the right position for lubrication; and each being surmounted by a neat ornamental head, they possess considerable elegance of finish.

MECHANIC'S LIBRARY.

Architecture, Details of Gothic, Vol. I., £2. 12s. 6d. J. K. Colling.
Builder's Price-Book, 1853, 8vo, 4s., sewed. Crosby.
Builder's Price-Book, 1853, 8vo, 4s., sewed. Taylor.
Engineer's Pocket-Book, 1853, foolscap 8vo, 6s., roan tuck. Adcock.
Euclid's Elements, First Six Books, 8vo, 2s., cloth.
Exhibition Official Catalogue, Vol. IV., imp. 8vo, 21s., cloth, gilt.
Facts, Year-Book of, 1853, foolscap 8vo, 5s., cloth. J. Timbs.
Industrial Drawing, 8vo, 14s., cloth. D. H. Mahan.
Linear Perspective, Principles and Practice of, 8vo, 6s., cloth.
Mechanics and Mechanism, 8vo, 2s., cloth. Burn.
Metals, On the Production of Precious, Trans., 2s. 6d. M. Chevalier Abbatt.
Practical Geometry, Illustrated, London, 8vo, 1s. 6d., cloth. Burn.
Rural Architecture, plates, oblong 4to, 30s., cloth. R. Upjohn.
Weaving, Art of, 2nd edition, royal 8vo, 18s., cloth. C. G. Gilroy.

RECENT PATENTS.

LEAD PIPES AND SHEETS, AND COPPER ROLLERS.

John Weems, *Johnstone, Renfrewshire.—Enrolled November* 31, 1852.

This invention consists of a series of improvements upon the very elegant process of making leaden pipes on the "maccaroni" principle—that is, by the expression of the metal in a continuous tubular stream from a receiving cylinder under hydrostatic pressure. One form of machine is arranged as well for the manufacture of ordinary soft lead pipes, as for harder pipes of block-tin, a metal which has hitherto been too intractable for manufacture by the pressure system. It stands independently on the floor, and has a vertical action, the hydrostatic cylinder forming the base, and wrought-iron tension rods pass upwards from it to a powerful cross-head, which a fixed tubular piece brings downwards, carrying at its lower end a hardened steel ring as the pressing die. This ring forms the exterior of the pipe, its tubular holder being fitted to work within the bore of the metal receiver, which is secured on the top of the hydrostatic pressure ram, working upwards. The bore of the pipe is formed by a steel mandril standing up from the centre of the bottom of the metal chamber, to which it is cottered down. In commencing to work this apparatus, the pressure ram is let down to its lowest position, so as to clear the open upper end of the metal receiver from the shaping die, and allow of a charge being put in. Then, as the pumping action elevates the pressure ram, the corresponding elevation of the receiver carries up the charge against the stationary die, when the compressed lead or tin, having no other means of escape, exudes, in the form of a pipe, through the narrow annular outlet between the exterior of the core bar, or mandril, and the interior of the annular die. The core bar, being fixed in the metal receiver, of course travels with the charge, and there is no actual frictional contact in working, except at the very point of escape, where the die shapes the pipe. In other terms, none of the charge is disturbed in the mass; the upper layers only oozing out as the ram rises. This plan of machine also possesses many other minor advantages, as the capability of producing any length of pipe without a break; whilst the details are greatly simplified, and very accurate work is turned out. A peculiar novelty is also proposed by Mr. Weems, in the manufacture of copper rollers for calico-printing purposes; by this plan the tubular mass of copper is cooled with water as it issues from the receiver, so as to retain its shape. Such rollers, it is presumed, would be extremely dense, and well suited for the engraver's purposes. The patentee also employs another modification of this class of machinery for the manufacture of sheet lead, the metal being first shaped into a tube of large bore, the metal being taken off from the full bore of the receiver, as the annular discharging space is comprehended between the interior surface of the receiver and the exterior of the stationary die. As this large pipe flows out, it is cut open by a fixed knife, and is then passed over guides and through rollers for being opened out and flattened into sheets. The whole of the mechanical details are excellently arranged, and do great credit to the patentee, who has had many years' experience in this particular branch of mechanical construction.

HORSE HOE.

John Martin, *Barmer, Norfolk, Farmer.—Enrolled Jan.* 29, 1853.

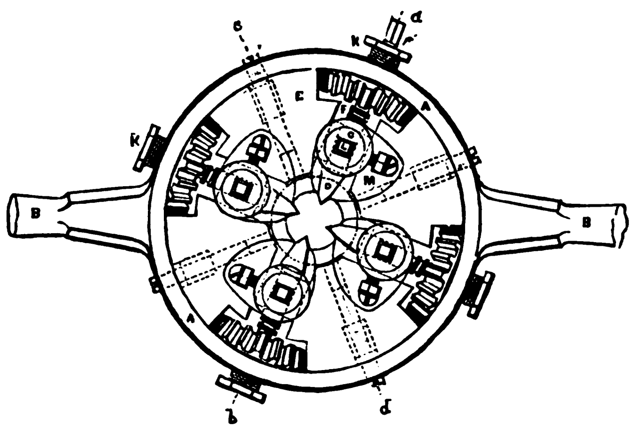
Mr. Martin's hoe, an attractive drawing of which proved so interesting at the recent Society of Arts' Exhibition, is a very efficiently designed, and a very well-finished piece of agricultural mechanism. It consists of an open rectangular timber frame, running upon a pair of large wheels, with serrated peripheries, each of which wheels carries a spur-wheel in gear with a toothed pinion fast on a first motion transverse shaft. It is through this shaft that the whole of the mechanism is directly actuated by the natural revolution of these wheels, as the hoe is drawn along by a single horse. This shaft carries a spur-wheel gearing with a similar but smaller wheel on another transverse shaft, from which the motion is conveyed by suitable bevel gear to a longitudinal shaft passing to the rear of the machine, where the rotatory hoes are carried in bearings in a separate frame, which is set on four plain running wheels. These arrangements are all duplex, so that there are two separate hoes at work, to hoe two lines of turnips or other green crop at once; each hoe consisting, in reality, of four separate earth-lifters, arranged on adjustable arms round a boss keyed on the shaft. Thus, as the machine proceeds, each set of hoes earths up one side of a row of plants, leaving them in readiness for being singled by hand in the usual way. The beams of the after-frame carrying the hoes are steered so as to be retained in a track parallel with the lines of plants, by means of a duplex lever handle fast on an overhead longitudinal shaft. This shaft carries a short lever, from which a link passes to one of the cross bridge pieces of the after-frame, so that, by partially turning the guide shaft, the hoe frame is directed to the right or left as required. Separate means of adjustment are also fitted for the purpose of regulating the interval between the hoes, as well as their depth of earthing, the variation of the speeds, and the disengagement of the hoes, at pleasure. The general construction of the machine is, of course, such as to allow of any intended reduplication of the hoeing details.

CUTTING SCREWS.

JOHN RAMSDEN, *Ardwick, Manchester.—Enrolled Jan.* 5, 1853.

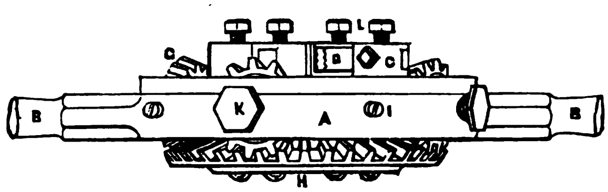
Mr. Ramsden's invention relates to a very efficient substitute for the ordinary die or chasing, with which the screw-maker forms his screw-threads—the essential peculiarity of the new contrivance being the bringing the cutting edge to a point, and making it capable of cutting

Fig 1.



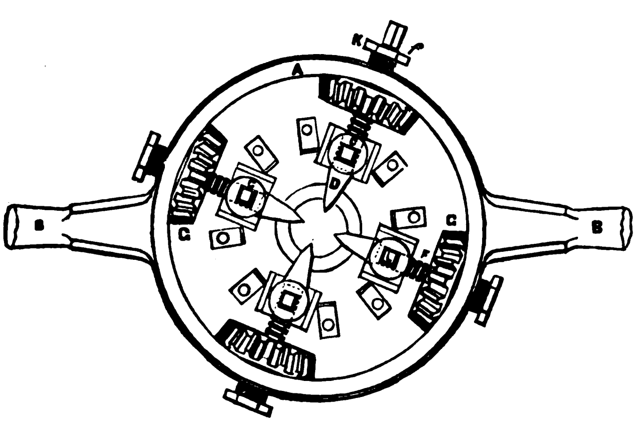
in both directions. Many advantages are involved in this modification, which combines the expedition of the common die with the truth of the chaser; whilst the thread is actually cut out of the body of the metal without any raising pressure, or the distortion of the

Fig 2.



thread, as with the die, which raises or relieves the thread—making that point of the screw of a larger diameter than the uncut portion of the blank. The same cutter, on the new plan, will also cut any diameter of screw, from ⅛th inch up to twelve inches; whilst an

Fig. 3.



ordinary die, made for cutting ½-inch screws, will cut neither 7-16ths nor 9-16ths screws. Again, the new cutter being a pointed tool, is capable of being ground upon a stone like other common cutting tools; it works easily in cutting, and is free from the evil of frictional heating. It also holds, cuts, and gives the rate of the thread itself, so that it is not liable to the defect of the screw-cutting lathe, in which the vibration or "back lash" of the guide-screw and pinion occasions considerable inaccuracy.

Fig. 1 represents a face view of the improved apparatus complete; and fig. 2 is an edge view corresponding. Fig. 3 is a face view, with the slides removed. Fig. 4 is a section taken through the line, A B; and fig. 5 is a similar view taken through the line, C D; *a a* is an outer case or box, to which the handles or levers, *b b*, are attached for working; *c* are four sliding blocks for holding the four cutters, *d*; and *e* are four slides for steadying the blocks; *f* are four screws formed with pointed ends, to prevent vibration, and working through the blocks, *c*; *g* are four bevel pinions keyed upon the screws, *f*, and connected or geared together by means of the bevel wheel, *h*, at the back. It will be observed, that one of the screws, *f'*, extends through the outer casing, *a*; and the end thereof is formed square, so as to allow of its being turned by means of a key. The blocks, *c*, are formed with bevel or shaped edges, and the slides, *e*, are made in a similar manner, in order to keep the blocks in their respective places. As the blocks or slides wear, they may be tightened up by turning the screws, *i*; and the screws, *f*, may also be tightened up by turning the screws, *k*; *l* are set screws for holding the cutters, *d*, firm in the blocks, and *m* are four shields, or clearers, for preventing the cutting from choking the screws or slides. It is evident that the cutters may be removed and replaced at pleasure upon slackening the set screws, and that they may be accommodated to the diameter of the blank to be cut, by turning the screw, *f'*.

Fig. 4.

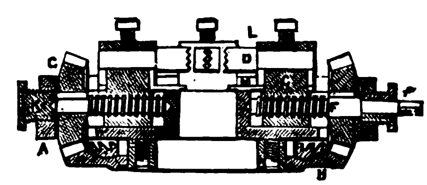
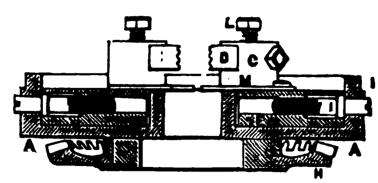


Fig. 5.



The patentee prefers to have the cutters with double points; that is to say, similar to a W instead of a V; but in that case they will obviously cut only the particular diameter of blank to which they are originally adapted.

When a machine is intended for the bench, two uprights or standards are substituted for the hand levers, and the blank is placed in a sliding socket, and turned by means of a winch handle, the cutter itself giving the speed. When the apparatus is adapted for mechanical power, two eyes are used instead of the levers, at a sufficient distance apart, to work upon the slide rods of a screw-cutting lathe, the shaft to be screwed revolving, whilst the cutting apparatus slides.

MANUFACTURE OF INDIA-RUBBER AND GUTTA PERCHA.

EMERY RIDER, *Bradford, Wilts.—Enrolled Jan.* 20, 1853.

Mr. Rider's invention relates more especially to the treatment of gutta percha by a preparatory process, in order to fit it for being effectually vulcanized, and to make it more suitable for practical application to a great variety of uses than heretofore. The insuperable difficulties hitherto encountered in attempting to cure or vulcanize gutta percha, have arisen in a great measure from erroneously considering the raw material to be identical, or nearly so, in constitution and chemical properties, with caoutchouc, and that the same routine of processes is applicable in the conversion of both substances. The two gums are, in reality, very different from each other, being obtained from trees belonging to distinct botanical orders. Foremost amongst the peculiarities in which the two are found to be essentially different, is that of their behaviour under the influence of heat. In its original raw state, gutta percha, in addition to its frequent admixture with fibrous impurities and other foreign matter, is by no means fitted to be at once mixed with sulphuric compounds, by reason of its possessing within its substance certain volatilizable ingredients of such a nature, as to interfere materially with the after effect of vulcanization. It is primarily essential to the success of the vulcanizing process, to get rid of the solid impurities which break the continuity of the mass, and it is additionally necessary to expel the volatilizable ingredients, whether these consist of the elements of water, volatile oils, or acids. After such preparatory cleansing, which is necessary under all circumstances of treatment, the gum undergoes the first stage of these improved processes, by being heated alone to such a

temperature as may suffice to reduce it to a soft pasty consistence, or a thin dough or batter, which result is usually attained by the agency of a temperature of from 400° to 450° of Fahrenheit. But the necessary temperature varies considerably with different samples of gutta percha, some qualities demanding a temperature no higher than 300°. The time occupied in this heating process materially depends upon the actual heat employed therein, as well as on the mass and the state of aggregation of the material at the time. It must, however, be so managed, that a uniform temperature is given throughout the entire mass. From two to four hours are usually found sufficient for the purpose, the heat being applied by means of hot metal rollers, or by any other easy mode of applying regular temperature, such as in a stove heated by steam or hot air. This heating process, besides driving off the purely volatile matters in gutta percha, causes a viscid oleaginous fluid to come away, also leaving the gum in a comparatively pure state. The gutta percha then, after having been subjected to this treatment, is either alone, or in combination with caoutchouc, mixed with the well-known ingredients, and by the agencies, and in similar, or nearly similar, proportions as are used in curing or vulcanizing caoutchouc; but hyposulphite of lead or zinc is preferred. It is, however, found more advantageous in the manufacture of the gutta percha alone, to employ rather a less degree of heat in the grinding process, and a higher degree of heat in the vulcanizing process, than is ordinarily employed in the manufacture of caoutchouc. Certain minor modifications being introduced where peculiar special uses are involved—for example, when a hard inelastic or comparatively inelastic compound is wanted—more mixture, and a higher degree of heat is used, than in the manufacture of a very elastic gum.

This simple and inexpensive process effects a wonderful change in the value and properties of the gutta percha. Indeed, no after treatment seems capable of bringing the gum to the perfection attained by Mr. Rider, if this preliminary process of his is neglected.

REGISTERED DESIGNS.

OVAL-PINNED HACKLE.

Registered for Mr. John Worrall, *Gill Works, Bernard Lane, Sheffield.*

The ordinary hackle pins employed for dressing flax are simply tapered pins, cylindrical in transverse section, set upright in fixed holding stocks or plates, in a row of about twelve in width. Upon this arrangement Mr. Worrall has made an important improvement, by substituting pins which are oval in transverse section. The section is not a pure oval, however, but tapers off to a sharpened edge on each side, somewhat like the cross section of a cricket bat, for example. The pins are driven through metal plates from the lower side, the plates being held down on the fixed stock; and each pin is so set, that the transverse axis of the sectional oval is parallel with the line in which the flax or hemp is drawn in the operation of dressing. In this way a sharp edge is presented in the direction of the strain caused by the passing fibres, giving a much smaller direct resisting surface than in the common cylindrical-pinned hackle. Increased strength is also secured in relation to the quantity of material employed; and the fibrous material may be dressed lower down on the pins than is practicable with the ordinary plan, and the amount of waste is reduced. This simple modification, which only carries out what has long been done in combs of various kinds, cannot but be of considerable value to the flax-dresser.

COMBINATION GOLD-DIGGING TOOL.

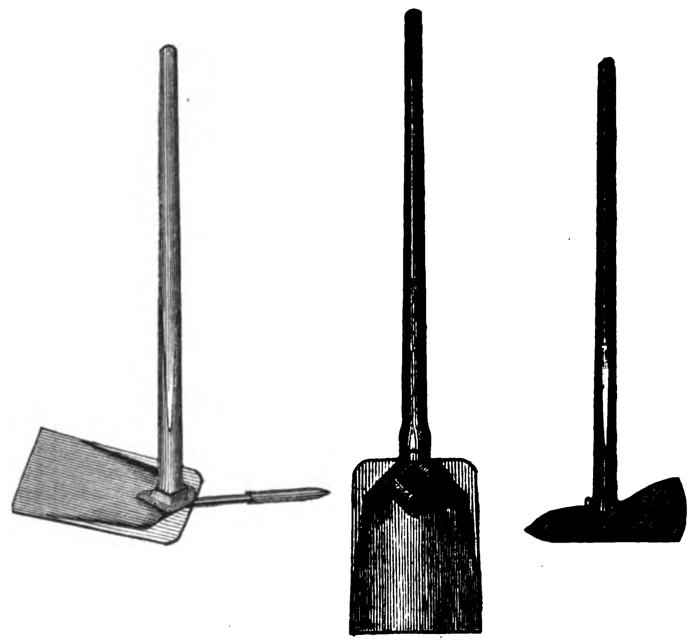
Registered for Mr. J. Lee, *Dale-End, Birmingham.*

This ingenious tool comprises within itself four separate adaptations. Fig. 1 is a steel shovel, with loose handle fitted to it, to suit all the varieties; fig. 2 is the same shovel altered for use as a pick and scraper; fig. 3 is the same handle fitted with an axe, formed with a pointed hammer for granite breaking; and a fourth arrangement, which we have not engraved, shows how a powerful crow-bar may be formed by fitting a short additional bar to this universal handle.

Considerable praise must be awarded to Mr. Lee for his practical skill in effecting these combinations, as the details are well-proportioned and balanced. Armed with this tool, the gold-digger is independent of the extensive array of ordinary implements, as, with the combination instrument, fig. 2, upon his shoulder, and the axe-head and short point of the crow-bar in his hand, he may journey freely to the scene of his operations; and when he commences work, he is ably assisted, by the peculiar fitness of the several combinations, for the work of excavation.

The incessant hard work of a pick rapidly wears away its point, but the combination tool makes provision for one or more extra points to fit

Fig. 2. Fig. 1. Fig. 3.



on the end of the pick, and renew its point. These are of small weight and cost, and may be carried in the pocket. The pick, working in conjunction with the steel plate of the shovel, which is in the position of a scraper, to remove the loosened earth, causes a saving of time, while the quick change from scraper to shovel, effected by withdrawing the handle from the eye, and fitting the prong of the pick up the hollow socket made for its reception in the handle, will prove highly convenient. The axe-head works with the hammer, and is fitted to the same handle, an arrangement which balances and adds force to both.

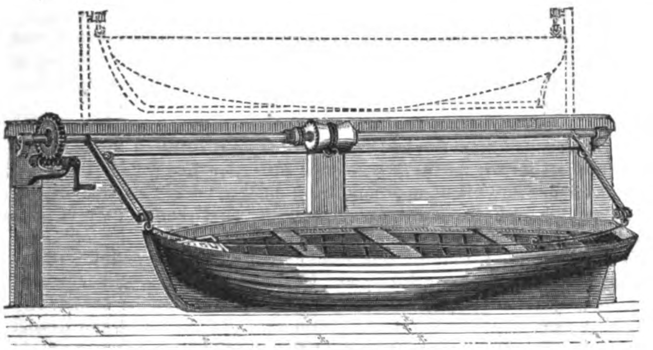
LAUNCHING APPARATUS FOR SHIPS' BOATS.

Registered for H. Bridson, Esq., *Bolton-le-Moors, Lancashire.*

In the language of the Society of Arts' Exhibition Catalogue, "this apparatus is intended to provide an easy mechanical means for lowering boats by the most inexperienced persons without risk." The inventor states that he does not bring forward his system of boat management in opposition to many other contrivances already before the public, as such existing plans are simple and effective as far as they go; but he argues that they do not go far enough to meet all the requirements of the case, which imperatively demands that all ships' boats, in whatever position they may be, whether stowed on deck, or slung over the ship's side, should be capable of disengagement and safe lowering, by simple mechanism, quite independent of the exertions of tutored hands. But the apparatus we already possess is chiefly applicable to sea-going vessels only, and involves the necessity of having the boats constantly slung on the davits over the ship's side; or, as Mr. Bridson terms it, at "full cock;" for, if brought on deck, all the difficulties of the original system are met with. In the large steamers of the Atlantic, for example, the boats are seldom or never required to be stowed on deck; and to these, the present suggestion does not apply so much as to the smaller class of vessels: coasters, channel steamers, and especially craft carrying large numbers of passengers, where the boats must often be brought inboard. When so carried, the new plan works so that one or two men —as the case may be—can raise the boat from the deck, lift it over the side, and lower it down, by a single actuating handle. The perspective sketch, fig. 1, represents the boat as hoisted inboard, the view being taken from the deck. The mechanism consists essentially of a main horizontal shaft, carried in steps bolted to the bulwark stanchions, and having the davits keyed or welded on it. This shaft, together with the davits, may be made to revolve at pleasure by a winch handle, and worm and wheel at one or both ends. The tackle falls are attached to the boat, by being rove through eyes at the stem and stern, and led

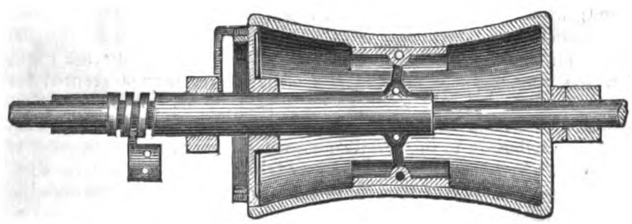
under the thwarts of the boat or under the gunwale, and both ends are made fast round one elect in the centre of the boat, so that both are cast

Fig. 1.



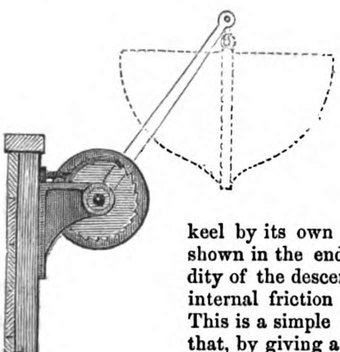
free, simultaneously, when required. The falls may be rove through the blocks at the ends of the davits as usual, and led through eyes or sheaves,

Fig. 2.



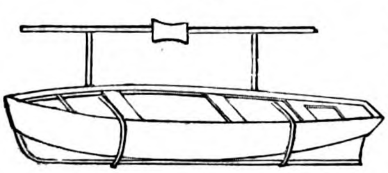
and thence on to the drum, which runs loose on the shaft, whilst it is prevented from revolving by the detent or the ratchet-wheel.

Fig. 3.



When the boat is to be lifted from its position on deck, as shown in fig. 1, the turning of the winch carries round the main shaft, and with it the davits, to the position indicated by the dotted lines. At this moment the detent is released by coming against a stop; and the drum being thus free to revolve on the shaft, the boat at once lowers itself on an even keel by its own weight. This is also additionally shown in the end view, fig. 2. To check the rapidity of the descent, the drum is furnished with an internal friction apparatus, as delineated in fig. 3. This is a simple knee-joint contrivance, so adapted that, by giving a half turn, or less, to the handle, in either direction, the screwed boss, on which the knee-joint friction levers are fixed, is made to traverse along the shaft, to bring the friction pieces into or out of gear—the screw being acted on by a fixed pin. The principle of this friction stopper may, indeed, be familiarly illustrated by a reference to the opening and shutting of an umbrella. Fig. 4 shows another simple modification of the traversing davits.

Fig. 4.



Mr. Bridson has produced several modifications of the apparatus, but the principle of the vertical swinging davits is the same in all.

BOBBIN NAIL FOR COTTON-SPINNERS.

Registered for Mr. Thomas Carr, *Chowbent, near Manchester.*

In that class of the cotton-spinner's twisting machines, wherein the bobbin and spindle are each driven by separate positive connections with the gearing, as in the "slubbing" and "roving" frames, the bottom flange of the bobbin is locked to the carrying-plate of the bobbin motion by means of a short nail driven into the bobbin—the projecting head forming the locking projection. The nail usually adopted for this purpose resembles a common tack, with a stout thick head tapering towards the shank. Such nails are extremely liable to be driven too far into the bobbin by the constant falling of the latter upon the carrying-plate, and thus split the flange, unless a separate washer is put on under the head; and they are also difficult to withdraw, so that the "tackler," or attendant, often drives the head quite up, and then puts in a new nail, when the old one has ceased to have a certain hold. Mr. Carr remedies these defects by making the nail with a stout flange at the base of the head, the head itself being made a little broader at the base than at the top. This flange effectually prevents the nail from being driven too far into the wood, whilst the disengagement of the bobbin from the carrying-plate is much facilitated by the slight reverse taper of the new nail head. The practical value of this simple little contrivance will be understood at once by every practical manufacturer.

PORTABLE STOVE AND COOKING KITCHEN.

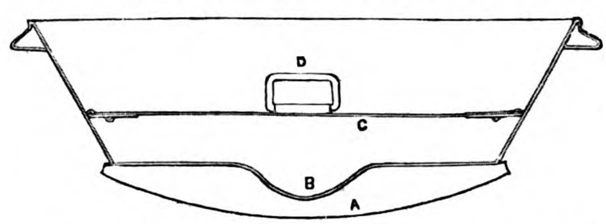
Registered for Messrs. T. F. Griffiths & Co., *Bradford Street, Birmingham.*

This compact apparatus—measuring 11 inches in length, 7¾ inches in width, and 10 inches deep—comprehends a stove, with spirit-boiler and lamp, a stew-pan and cover, two spirit bottles, frying-pan, tea-kettle, pot, cup and saucer, oval dish, pepper-box, oval tea-box, spirit-measure, and funnel. Its case resembles a short pillar, but is elliptical in transverse section; and having a hinged side door for putting in the lamp and spirit-boiler, and an expanded top for receiving the vessel to be heated. The lamp occupies the base of the stand, and immediately above it is a shelf to carry the spirit-boiler. In using the apparatus, a measure of spirit is put into the boiler, and the lamp beneath being lighted, the heat causes the evaporation of the spirit from the boiler, in the shape of flame, through holes in the top of the case. This furnishes a very powerful fire—spreading beneath and round whatever cooking vessel is placed on the top. The powers of the apparatus are to be told in the fact, that it boils a quart of water in three minutes.

GOLD-WASHING MACHINE.

Registered for Mr. A. Lyon, *Windmill Street, Finsbury.*

This machine, made by Messrs. T. F. Griffiths & Co., of Bradford Street, Birmingham, combines within itself a cradle, washing machine, and detective apparatus. Our engraving represents it in vertical section.



It is an open vessel, supported on rockers, A, and having a central cavity, B, in its bottom, to contain mercury. A rim runs round the interior a little more than half way down, to carry a moveable perforated disc, C, which has a handle, D, for lifting off by. It may be used with or without water, by depositing a little mercury in the central recess, as this will collect every grain of gold in the treated mass. It is made of thin metal, and so light that either a lateral or circular motion can be easily given to it.

REVIEWS OF NEW BOOKS.

Second Report of the Commissioners for the Exhibition of 1851. To the Right Honourable Spencer Horatio Walpole, &c. &c., one of Her Majesty's Principal Secretaries of State.

This Report, like the first, has, at her Majesty's command, been presented to both Houses of Parliament, and may be said to dètail the concluding labours of the Royal Commissioners. It is preceded by a transcript of the supplemental charter granted to the Commissioners, and has attached an appendix containing the substance of the principal materials upon which the Royal body have arrived at the determination, with regard to the disposition of the known surplus funds, stated at large in the Report. The Report informs us of the important fact of the actual disposition of the money, without the possibility of recovering it back; and,

perhaps, the chartered authorities have acted, on the whole, prudently, in thus taking the bull by the horns, and preventing a long and probably fruitless controversy, which might have ensued had the scheme, now irretrievably entered upon, been but proposed for public consideration. This being the state of the case, it was natural for the Commissioners, who had chosen their position, to seek on all sides for arguments to maintain it; and their Report is accordingly read as an advocate's speech to a jury, in which no point is left unnoticed which may support their expenditure of the money. In some places, indeed, the facts detailed are very amusingly, although seriously, brought forward; and here we allude more particularly to the cunning there has been displayed in obtaining possession of the large tract of land, purchased through the instrumentality of parties who might not be supposed to be dealing with the vendors as for the nation. We do not complain of this, knowing how often the finances of the country have been, on analogous occasions, completely squandered away in "jobs;" but it is the amusing self-complacency which oozes out individually, in the petty diplomacy, which causes us to make the observation.

It appears that the receipts, including the balance in hand, amounted to £219,837. 18s. 3d., and that the expenditure, from the 1st of March to the 31st of October last, inclusive, amounted to £25,199. 15s. 3d., and the probable future expenses, in connection with the Commissioners' services, to £21,340; so that there remains an estimated balance of £173,298. 3s., applicable "to purposes," as recited in the charter, "strictly in connection with the ends of the Exhibition." In addition to this large sum, the Commissioners are in possession of a collection of articles which have been presented to them by exhibitors and by foreign Governments: the value of which collection has been estimated at nearly £9000, and which is now temporarily deposited in Kensington Palace.

We are also informed, that on the occasion of the rebuilding of the Houses of Parliament, the Government wisely formed a collection of casts, at great expense, for the use of the works. One portion of this collection—consisting of 3489 specimens of enrichment, taken from the best examples, in this as well as in foreign countries, for the guidance, as to style, of the carvers employed in the decorative portion of the building—is, at present, partly at the Government works at Thames Bank, and partly at the new Houses of Parliament, but is intended to form a portion of a National Museum of Mediæval Art, when proper accommodation can be provided. There is, it appears, also an additional collection, which has cost about £7000, consisting of 3282 casts from models prepared for the stone and wood carvings already executed at the building, and which is applicable to national purposes.

It is likewise very satisfactory to be told, that notwithstanding the difficulties experienced since its first establishment in 1837, the Government School of Design has, by its central and provincial labours, fostered the studies of 20,000 pupils; and has, at present, 3000 under its control. The sum annually voted by Parliament for the support of the Institution has gradually increased from £500 (its amount when the school was first established) to £17,920, shown in the estimates for 1852-3.

The Report details the many inconveniences found in existing national establishments, on account of want of space for performing the operations carried on in them, or for the display of their varied stores; and it particularly instances, amongst others, the constant reference made, in the recent discussions on the subject of the patent laws, to the want of a building, in which models and plans of inventions might be deposited for the advantagê of the inventor and the information of the public.

The Commissioners say, "It is well known that there are numerous valuable models existing in this country, which it would require little effort to obtain, if suitable accommodation could be provided for their display and useful illustration. If means were offered for exhibiting and testing new machines under scientific superintendence, we have reason, from the experience of the Exhibition, to believe that they would be largely taken advantage of; and it cannot be doubted that such means, used for the purposes of instruction, and with the co-operation of our eminent civil engineers and of the scientific societies, would soon give a new impetus to invention. . . . A systematic training in the principles of machinery is a great desideratum in this country."

They also observe, that institutions for industrial instruction exist in most of the continental States, and have been growing into increased development during the last fifteen years. With ourselves, numerous societies have been from time to time introduced, and are supported by voluntary subscription, for the purpose of improvement in special things—matters of science, art, and literature: London alone numbering upwards of 100. And it is considered that a want of union and community between these societies has prevented, and of itself tends to prevent, their advantages being so fully participated in as might be; while the entire youth of the country is positively debarred fostering its genius for any particular study, by having no systematic place of instruction open in which it might be grounded in natural principles, and which, in order to eventual success, must sooner or later be acquired. The Commissioners, in a note, give extracts from the lectures delivered at the Society of Arts by Mr. Warrington Smythe, Professor Edward Forbes, and Dr. Playfair, showing the immense expenditure, to no purpose, of time, and money, and talent, and the blunders that were committed by persons attempting to achieve things which the simplest knowledge would have told them were impossible to be accomplished.

The Commissioners, acting upon these suggestions, considered that "the requirement most felt by the country is an institution which should serve to increase the means of industrial education, and extend the influence of science and art upon productive industry;" and that this institution should have a cosmopolitan character, so that the advantages of it may be extended to the citizens of all countries.

It is obvious that, to meet this need of the age, some definite *system* of proceeding must be struck out, and some *locality* purchased where that system may be developed. The system proposed may be sufficiently collected from the preceding observations; and that which the Report principally communicates to us is, that *the locality has been purchased.*

The Commissioners, rejecting the site of any of the parks, have selected the Gore House estate, a portion of which was connected with the name of Mr. Soyer during the Exhibition, and which our readers will remember to be situated at a few yards to the west from the principal entrance to the Crystal Palace, which is itself to be devoted to an enlarged National Gallery; while the adjoining lands, also purchased, comprising about seventy acres, may form the sites of the sister institutions. By the national purchase of some eighty additional acres adjoining the Park, and which may be made, a grand site of 150 acres may be secured for the benefit of the arts and sciences cultivated by us. What the Commissioners have done has been to lay out £153,500, part of the surplus, as their contribution to this eligible situation, and to make a deposit of £15,000, by which immediate possession of the property has been secured, and which may at once be opened, in extension of the Park, towards the rational exercise and enjoyment of the neighbourhood.

All questions of detail—the method of appropriating the ground among the different schools and societies, and the rules for their establishment and reciprocal intercourse, when established—are left for after consideration.

The Report is dated the 11th of November, 1852.

We think, on the whole, the labours of the Commissioners are deserving of the grateful thanks of the country; and we cannot close without, ourselves, humbly expressing our own personal sentiments to this effect to the illustrious Prince who has exhibited, throughout the arduous duties he has performed, so keen and just an appreciation of what is due to his adopted country, and so indefatigable a zeal in courteously co-operating with those whose feelings are in harmony with his own.

A Treatise on the Screw-Propeller. By John Bourne, C.E. London: Longman, Brown, Green, & Longmans, 1852. Pp. 243. Plates and Woodcuts.

(*Third Notice.*)

Comparative Efficiency of the Screw and Paddle as a Propeller.—We have, under this head, a detailed account of numerous experiments tried to determine the relative merits of the two propellers, between the *Archimedes*, *Rattler*, and *Niger*, screw steamers; and the *Ariel*, *Swallow*, *Beaver*, *Widgeon*, *Alecto*, and *Basilisk*, paddle steamers—the *Archimedes* competing at different times with the first four of the latter. The conclusion deduced from these experiments is, that—

"In smooth water and with both vessels in their best trim, screw and paddle vessels are of about equal efficiency, or rather the advantage rather lies with the paddle, though the difference is so small as to be of no practical account. In deep immersions, screw vessels, however, have a very decided advantage; but paddle vessels again have a very decided advantage in the case of head winds. Screw vessels, when set to encounter head winds, are most wasteful of power; but I have discovered a means of remedying this defect, which consists in sinking the screw deeper in the water, and placing it further forward in the dead wood; and with these modifications screw vessels will not be so wasteful as paddle vessels, when contending with strong head winds. Up to the present time, however, paddle vessels have a decided advantage over screw vessels in all cases in which a strong head wind has to be encountered; and if the comparison be made between the feathering wheel and the screw, instead of between the radial wheel and the screw—which last species of wheel the foregoing comparison supposes to have been employed—the advantage on the side of the paddles, so far as regards efficiency, will be still more decisive. Screw vessels, however, as they will be hereafter constructed, will, in my opinion, be found preferable to paddle vessels under all circumstances; and, if this view be correct, paddle vessels must be abandoned for all purposes of ocean navigation. The whole question turns upon the power of constructing screw vessels which shall be as efficient as paddle vessels, or more efficient, when set to encounter a head wind. And I have no doubt whatever that this end will be attained by the means which I have proposed for that purpose."

Mr. Bourne very clearly states the reasons for preferring the screw as a propeller, thus—

"I do not consider it necessary to enter into any inquiry respecting the comparative eligibility of the screw and paddle in any other respect than as regards their relative

mechanical efficiency as propellers, since, in all other points in which a comparison could be made, the advantage manifestly lies with the screw. The screw, it is obvious, is a much less cumbrous instrument than the paddle, and interferes less with those nautical arrangements which are judged proper for a vessel that has to employ sail. At the same time, it does not appear, from the experiments which have been recited, that the superiority of a screw vessel under sail and steam combined, or under sail alone, is so great as to constitute any material advantage. . . . . In vessels, therefore, in which auxiliary power has to be introduced, it is not so much on the ground of superior efficiency that a preference is to be given to the screw, as on the ground of greater facility of application. Screw engines may be made to occupy a much less space in the vessel than paddle engines, and are also lighter and less expensive. In the case of war vessels, the whole of the propelling machinery may be set below the water line, and will therefore be more out of the reach of shot, and the decks will be left free and unobstructed for the service of the guns. For vessels, therefore, with so small a proportion of power as to be inconsistent with the intention of encountering strong head winds, and for vessels also which are intended for purposes of warfare, the screw is unquestionably the best propeller; while for vessels with a large proportion of power, and which are required to steam against variable or adverse winds through voyages of no great length, but with the greatest regularity and economy, the paddle is as assuredly the best propeller. If the voyage be a long one, however, relatively with the size of the vessel, so that the supply of coals necessary for the voyage greatly affects the immersion, then it will happen that the paddles will be so deep in the water at the commencement of the voyage, or will have such an inadequate immersion at its termination, as to produce at those times a most defective performance. It therefore happens, that paddle vessels of large power, when starting on a long voyage, will sometimes be outstripped in speed by screw vessels of a power greatly inferior; for the paddle-wheel acts in its worst manner when sunk very deep in the water, whereas the screw acts in its best."

Comparative merits of screws of different kinds.—This may be considered to be the most important division of the subject, and it is, at the same time, one which embraces points on which the greatest difference of opinion exists amongst engineers.

The rules given for determining the best proportions of screw, are derived from numerous experiments made in the *Rattler*, *Dwarf*, *Minx*, and the French war steamer *Pelican*. The experiments with the last-mentioned vessel were conducted with great ability by MM. Bourgeois and Moll; and these gentlemen subsequently drew up a very complete report, of which Mr. Bourne gives an abridged translation.

From the great number and variety of the experiments, and the care with which the observations were made, and the results reduced to calculable terms, this report is a most valuable addition to the treatise. The labour of translation should not, however, have been confined to the text. It is not, we allow, a difficult matter to reduce French into English measures, and, of course, the reader can do it for himself; but the value of the voluminous tables of results obtained in the *Pelican* would have been considerably enhanced, if Mr. Bourne had saved the reader this labour. The proportions of the various elements, and the consequent effects, would be much more readily discernible if expressed in terms to which the student is accustomed. It would, also, have greatly facilitated investigation, if the tables had been printed in a less crowded manner; in their actual form it is difficult to keep to one line across the page, in tracing out each experiment.

Our space will not permit us to do more than glance at the deductions from the experiments referred to. They are given briefly in the chapter headed, *Recapitulations of doctrines and conclusions*; thus—

"The comparative efficiencies of different screws will depend a good deal upon the qualities of the vessels to which they are attached, and also upon the dimensions of the screws themselves. If, from the fulness of the vessel, or the small diameter of the screw, there is much slip, then a screw with a pitch increasing both in the direction of its length and in the direction of its radius, and with the arms slightly bent backwards towards the stern-post, will give the best results. But if the screw be so proportioned to the vessel that there is little slip, then a screw with a uniform pitch will give as good results as any other kind. Screws of two blades, four blades, and six blades, appear to be about equally efficient; but the greater the number of blades, the greater should be the pitch.

"Screws of two blades are usually made as large in diameter as possible, and the pitch is made about equal to the diameter, or a little more, and the length about one-sixth of the pitch. As the size of the screw, relatively with the midship section, is increased, or as the resistance of the vessel is diminished, so may the pitch be increased, and the length of screw diminished. The best proportions for screws of two, four, and six blades, if constructed on the ordinary principle, is given at page 161. The ordinary principle, however, stands greatly in need of emendation, and, in constructing a screw vessel, these are not the elements I should employ, though they will enable results to be arrived at, at least fully equal to any which have heretofore been obtained. . . . . The form of the hull is perhaps the most important question connected with the efficiency of screw vessels, and the most material condition to be observed is to make them fine in the stern. Both ends, however, should be made very sharp, and the vessel should be made very long, and should be broad at the water line, and with some flam of the side, in order to enable her to bear the action of the sails without being careened too much. The portion of the vessel immersed in the water should be made without flat surfaces in it, and the bottom should not be flat, but should rather approach in the cross section to a compromise between a semicircle and a triangle, the semicircle being the form which has least friction, and the triangle being the form which has most stability. . . . . Next to the form, the size of hull is one of the most important questions that can engage attention, as it has a most important influence upon the efficiency. The capacity of a vessel enlarged symmetrically, increases as the cube of any increased dimension, the sectional area increases as the square, and the resistance only as the dimension. A vessel therefore of double the length, breadth, and depth, will have eight times the capacity, four times the immersed section, and only twice the resistance. In the *Minx*, the resistance per square foot of immersed section I estimate at about 71¼ lbs., at a speed of 10 knots an hour; whereas in the *Rattler*, a larger vessel, the resistance per square foot is only 25 lbs., at a speed of 10 knots an hour. Large vessels of good form will be able to carry merchandise more cheaply than small vessels, and they will also be able to realize a higher speed. To realize the same speed under steam alone, a vessel of eight times the capacity will only require twice the power, and the sails of the larger vessel will be much more effective, since, in fact, a larger amount of sail-power relatively with the resistance will be applied."

We understand that a company is being formed to establish a line of steamers to India and Australia—the steamers to be constructed on the principle just quoted. These vessels are to be from 8,000 to 10,000 tons burthen! In a mechanical point of view, the plan is feasible enough; but viewed commercially, it is *too* absurd. Doubtless such vessels could carry full cargoes and complements of passengers at a much cheaper rate than smaller vessels, if they could get *filled* at all, or in any reasonable time. But we imagine some years must elapse before any line of traffic will be able to support such "elephants," even as "gifts."

It is manifest, from the experiments with the *Pelican*, that vessels having different degrees of resistance require screws of different proportions. May we not go a step further, and conclude that the same vessel requires screws of different proportions under different circumstances, since her resistance is varied by such circumstances? Mr. Bourne does not report favourably on the expedients proposed by various patentees to meet this requirement. He, however, allows one of them to speak for himself in the appendix; and who appears to have some advantage in point of argument. Mr. Bourne's remarks are, perhaps, after all, rather against the mechanical defects and inconveniences attending the plans to which they refer, than against the possibility of deriving benefit from a capability of accommodation in the screw.

The differences of resistance met by different vessels, under identical circumstances, must surely be much less than those experienced by the same vessel under different circumstances; and if, in consequence of the former, different proportions are requisite, so much more reason must there be for them with the latter. Not only may the resistance be increased, on the one hand, by head-winds, but it may also be considerably lessened, on the other, by favourable winds. Indeed, as stated on former occasions, when remarking on this subject, it seems to us that it is to the attainment of expedients to meet this requirement that the inventor should direct his attention; and we think, that sooner or later the difference, as to average speed, between the screw and paddle, will be found to consist in the fact, that the power of accommodation to circumstances of resistance will be attainable in the former more easily, and with less expense, than in the latter.

In treating of *screw vessels with full power*, the conclusion arrived at seems to be, that such vessels ought to equal, if not surpass, paddle vessels in speed, if the screw be placed deep enough in the water, and as far forward as possible; and that since, with two screws, the requisite propelling area can be got at a greater depth, they ought to give better results—such an arrangement, however, being more easily applicable to iron than to wooden vessels.

Screw vessels with auxiliary power.—Mr. Bourne is quite right in saying that this is the screw's "most valuable application"—not but that an auxiliary paddle vessel would be about equal in point of average speed, but because the application of auxiliary steam-power, wherein lies the great advantage, is much more convenient when the instrument adopted is the screw.

We have, under this head, a detailed statement of the commercial advantage of auxiliary screw steamers; and a company has been formed to establish a line of screw steamers between England and America, which, in its prospectuses, refers to this statement as an incentive to the enterprise. Pretty much the same remarks apply to this scheme as to the India line. Before entering on such an undertaking, something very like certainty should exist, as to the being able to obtain full cargoes and complements of passengers.

Screw Steam Vessels on Canals.—In reference to this head we learn that,

"Upon the whole, the introduction of steam vessels upon canals has not been attended with the measure of success that was expected. The cause of this result is not very difficult of perception. In any steam vessel of restricted width and length, but in which, nevertheless, a considerable rate of speed is intended to be maintained, the weight of the machinery and fuel must cause a considerable immersion; and upon all canals of the ordinary calibre, the large immersion of the hull will aggravate the resistance to a very serious extent, and correspondingly increase the cost of transport. At very low rates of speed, indeed, these evil effects will be less conspicuous; but at very low rates of speed, even very large barges may be drawn by two or three horses, and it appears to be hardly worth while employing a steam vessel for the purpose, unless a long train of barges could be towed at once. A long train of barges, however, would experience considerable delay at locks, for only one barge could generally pass through at a time, and the first barge of the train would have to wait until all the others had passed through, whereby greater delay would be caused than if each separate barge was dragged by horses. These impediments have hitherto prevented any very eminent success from being attained by steam vessels upon canals, and it appears to me that vessels of the character heretofore used, whether propelled by screws or paddles, are not calculated to realize that measure of efficiency which is indispensable to a successful result."

Comparison of different kinds of Screw-Engines.—We have here a complete analysis of the various arrangements of engines to which the peculiar necessities of screw-propulsion have given birth; and this is assisted by two large plates, respectively illustrating the two great classes of "geared" and "direct-acting" screw-engines, as well as by several other plates, giving examples of some of the engines on a larger scale. The plates are, on the whole, very good, particularly the large ones just referred to. There are, however, one or two instances in which a want of care is apparent. In Plate XII., for example, repre-

senting the engines of the *Amphion*, the position of the piston-rods is incorrectly and indistinctly delineated, which is the more to be regretted, as Mr. Bourne considers these engines to be about the best of the series. There is also a want of uniformity of style. The two very excellent plates of the engines of the *Fire Queen*, which are well and strongly brought out, are followed by others, of a comparatively faint and sketchy character. We also miss plates of the engines and lines of the French war-steamer *Pelican*, which would certainly have been quite as interesting as any of those which are given.

Whilst referring to the illustrations, we may add that, with regard to the woodcuts, very profusely scattered over the work, Mr. Bourne's only fault consists in his too closely copying the bad drawing of sundry patentees. We have often remarked how seldom the screw is represented in a manner sufficiently intelligible to the eye. From the atrocities frequently perpetrated by draughtsmen and engravers, it might be inferred that the instrument is of very difficult delineation.

To return to the varieties of screw-engines, Mr. Bourne urges the preference of direct action, more particularly since modern improvements in various details, such as the air-pump valves, have annihilated the inconveniences attending a high speed of piston. On the necessity of adopting some particular proportion between the power and the stroke of the engines, a point we have alluded to on former occasions, Mr. Bourne is quite silent. We must, however, repeat, that engineers will not have done all they can for the screw, until they have given this point due consideration—until they have ascertained how best to adapt the engine to the screw, and to the work it has to perform.

The Screw and Paddles combined.—Under this head, Mr. Bourne gives an account of his attempts to induce the "Peninsular," afterwards the "Peninsular and Oriental Steam-Packet Company," to adopt his suggestion of the introduction of screws into their old paddle-boats, to bring up their speed to modern requirements. He argues that better results would be obtained by the combination of the two systems than by either separately, if the arrangements hitherto in use with each be adopted—but not better than by the use of the screw alone, if applied in as efficient a manner as its capabilities really permit. He considers that one would act as a "fair wind" to the other; but is it certain that the combination of a fair wind and a propeller produce as great an effect as that derivable from a power equivalent to both, if applied separately, in the form of either? The only advantage likely to arise from the arrangement would, in our opinion, be the obtainment of a greater extent of propelling surface, perhaps more easily, and with possibly fewer drawbacks, than would result from the extension of the surface of either separately. This increase of the propelling surface would, of course, diminish the slip; but, after all, could any benefit be derived from the arrangement that would compensate for the increased complication?

Mr. Bourne has made use of the opportunity afforded him in the present work, to lay before the public several suggestions for improvement in nautical matters, not strictly coming under the head of "Screw Propulsion." Amongst these may be noticed his plan for making the sails of ships in strips, so that the impinging wind shall not interfere with the reflected wind. We fear Mr. Bourne hazards too much when, in speaking of the action of the sails, he announces the possibility of sailing directly in the wind's eye. We hope he will soon let the world know how it is to be done.

He proposes, further, to lubricate the immersed surface of ships, by means of a film of air, to be forced out from a slit in a pipe, laid along each side of the keel. This is not a newly-proposed expedient. We remember hearing of an actual trial of the plan, some years back, in the United States. A series of minute grooves were formed in the ship's bottom, and it was intended that the air should lodge in them, leaving only the intervening ridges to be in actual contact with the water. We think it would be quite sufficient to force out a supply of air at the lower part of the stem. At low speeds, little benefit would ensue from such lubrication, however perfect; and at high speeds, the air forced out at the lower part of the stem would be drawn under the bottom of the vessel, and efficiently cover it; in other words, it would only reach the surface in the time taken by the ship to accomplish her own length. Doubtless such an expedient would enable the vessel to sail faster; but it requires to be determined by experiment, whether the extra power needed to force out the air would not be an equivalent, or even more.

The idea, also mentioned, of providing an elastic connection between the sails and the ship, is very old. We have ourselves had many a discussion on the subject; and we should rejoice to see the plan efficiently carried out.

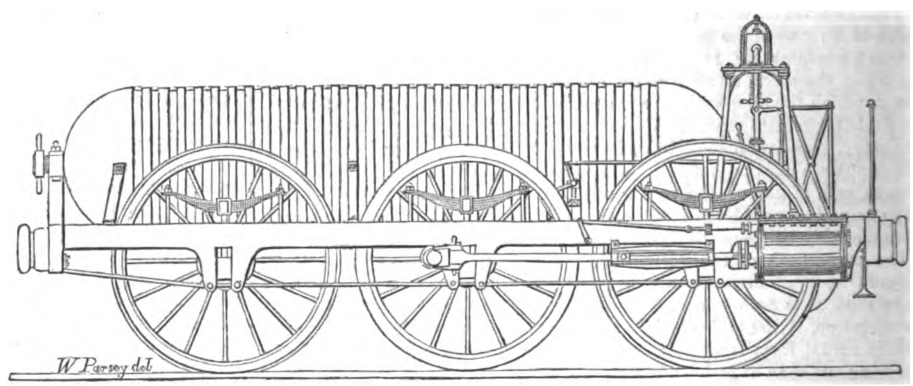
The work is rendered complete by the addition of an extensive appendix, containing many valuable tables; an able paper by Chief Engineer Isherwood, United States Navy, on the performance of the United States screw steamer *San Jacinto*, from the "Franklin Journal;" a notice of the performance of screw and paddle vessels on the Atlantic; further notes on the *San Jacinto;* a letter from Mr. Hays on feathering screws; a paper on screw-propulsion in the navy; a comparison of arguments for and against iron and wooden ships; and the specification of the auxiliary screw steamer *Water Witch*.

With all its faults, and they are but minor ones, the work is decidedly one of great merit and value; and whilst Mr. Bourne has presented a serviceable gift to the engineering community, he has also, we may venture to hope, more firmly established a previously well-earned reputation.

CORRESPONDENCE.

COMPRESSED AIR ENGINEERING.

Though the possibility is popularly entertained, like the quadrature of the circle and perpetual motion in science, the practicability of compressed air power has been given up by the generality of engineers as unattainable.



Compressed Air Locomotive.

Steam having gained the ascendancy and command over the working of railroads, a change from a system so well understood, for a repudiated practice scarcely comprehended, is not desired by the established and flourishing steam interests, which, as in all former instances, are opposed to the adoption and progress of improvements supposed to affect them.

The known power of compressed air has not hitherto been brought into use on account of the difficulty of controlling it at high densities, and of working it with a continuity, as well as a uniformity of pressure on the piston. That fatality having been perfectly overcome, no objection can be raised against the practicability of my patented engines, which only require to be worked on a line to give a satisfactory proof of their economy.

To prove the practicability of my machinery, I built, at my own expense, a small engine adapted to the narrow guage. Having by me a quantity of portable gas vessels, I connected thirteen of them to save the time and expense of making one large reservoir, which will account for the construction deviating from that proposed for large practical locomotives, the primary object being to demonstrate the power and perfect control to be obtained by my patented means. The engine weighed 1½ ton; the capacity of the reservoirs, 39 cubic feet; pistons, 2½ inches in diameter; 9 inches stroke; driving-wheel, 4 feet. By permission of the Chairman of the Eastern Counties Railway, D. Waddington, Esq., M.P., who kindly undertook that my experiments on the line should not be of any expense to me, my engine was conveyed to the Stratford workshop, where it was filled by the small pumps (2½ inch plungers, 6 inch stroke), used by me to fill the small models so much admired by the public when shown in Pall Mall East some years ago, and at the Great Exhibition in 1851. In obedience to an injunction not to exceed a pressure of 200 lbs. on the inch in the reservoirs, and as the experiment had to take place between the running of frequent trains, the pressure was only 165 lbs. per square inch, when the engine was placed for the first time on a rail. A pedal break-wheel was fixed on the centre of the driving-wheel axle, and the break-

block adjusted just to clear it; but on myself, son, Mr. Ashcroft (Superintendent of the Ways and Works), Mr. Trevithick (Locomotive Engineer), Mr. Isborn, Mr. Box, Mr. Else, and my man getting on her, the light springs giving way under the additional weight of eight persons, she started under that pressure on the break (unobserved in the hurry till her return), and ran from Stratford to Leabridge and back, a distance of 4 miles, in half an hour. The break-wheel, a rough casting, was polished with the friction. The working pressure was set by the regulator at 20 lbs. on the square inch on the pistons, only 2½ inches in diameter. This pressure propelled the engine and its passengers (2 tons), with the impediment of the break on a distance of four miles, at the rate of eight miles per hour. Thus, 39 cubic feet, at a density of 11 atmospheres, or less than 400 feet of atmospheric air, effected a performance which gave entire satisfaction to all who witnessed it. As the chief locomotive superintendent, who was absent during this first experiment, complained that the workmen neglected their business on account of the interest excited, through the favour of Mr. Waddington, I was allowed to make a second experiment; and the experimental engine was taken out of the way down to Cambridge, where it was filled by the same small pumps, to the same pressure as before, under the supervision of Mr. Stokes, superintendent of the locomotive department, and Mr. Hallows, principal foreman. Mr. Box, and three other proprietors of the Eastern Counties, came down to Cambridge, to witness the performance on the 2d July, 1852. The engine started opposite the 60th mile post, on the Waterbeach Junction. I drove the engine, attended by my two sons, Mr. Stokes, Mr. Box, and Mr. Macphail. The working pressure was set by the regulator at 15 lbs. only on the square inch, and she ran one mile in five minutes—rate, twelve miles per hour; then at 20 lbs., and she ran the second mile in four minutes—rate, fifteen miles per hour; the regulator was then reduced 1·15 lbs., and she completed a journey of five and a half miles in nineteen minutes. A steam locomotive, loaded with engineers, &c., followed, and witnessed this decidedly successful experiment. This small engine would have ran twenty miles, if charged to the density I had proposed to do. The analysis of the data of these experiments, and calculations fairly made thereon, with a practical knowledge of compressed air engineering, will give the best *prima facie* evidence of the economy to be effected by the use of this harmless power.

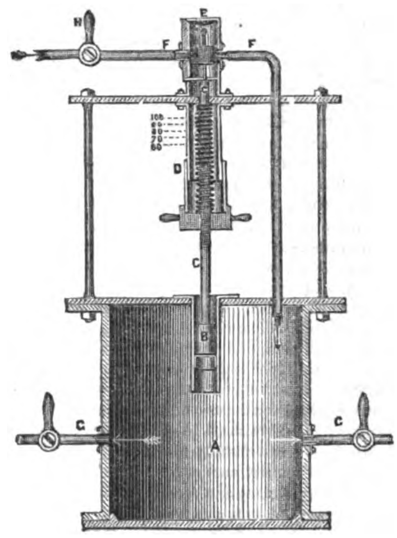
Having described the performances, and given the data of the experiments made by humble means and on sufferance, I will proceed to describe the leading feature of my invention, by which they were successfully accomplished, embodied in remarks that may tend to a better understanding of the improvements in locomotion. The practicability of the use of compressed air solely depends on the means of controlling it at high densities, and of regulating and producing a uniform and continuous working pressure. A compressed air locomotive is charged with an amount of power (previously prepared) for a given distance, and not generated as in a steamer, while running; consequently, so great an amount of power being packed up in so small a compass as a locomotive and tender, the pressure in the reservoir, which must be much greater than high-pressure steam, will require skilful control; and as this packed-up power has to be expended according to the friction or resistance of the engine, and the load it has to draw, it will be manifest that a certain and perfect means of fixing, maintaining, and adjusting the working pressure on the pistons, is of the most material consequence in the working of them.

In a steamer, it is necessary that the evaporating power of the engine should be able to generate sufficient steam, at a pressure in the boiler fully equal to the resistance of the engine and its load on the pistons, and it is the part of a skilful driver so to urge his fire as to continue this condition according to the duty required of his engine. But in compressed air engines, this skill and vigilant attention to the generation of the power will not be required, as compressed air will be prepared for him at certain stations, where he will replenish his engine with air, as he does now with water, to carry him on to another replenishing station. Taking up from stationary reservoirs in two or three minutes the amount of power that will carry him over, say 20 or 30 miles, his business will be simply to apply to the piston, by means of the regulator, a pressure that shall overcome the resistance, and to regulate the supply to the driving cylinders so as to effect the requisite speed.

All the steam generated in the boilers does not pass through the cylinders, as all the pressure indicated in the boiler above the pressure that overcomes the resistance of the pistons is lost power, amounting to a considerable portion of the power generated; but that will not be the case with compressed air, as there are no valves to suffer the escape of the pressure above the resistance of the pistons, and no loss of power can take place, as it must pass through the cylinders, and have done work, before it can escape at the blow-off passages. The material point, therefore, will be to ascertain the resistance of the engine and load, and to set the self-acting regulator correspondingly.

This important but simple operation is effected by a separate cylinder, with its regulating apparatus placed between the reservoir, charged to a very high density. This part of the machine restrains the violent force of the stock of power in the reservoir, and at the same time gives a constant pressure on the pistons. Being self-acting, after it is set to any given pressure, the engine will work steadily, and maintain a uniformity of speed, upon a level, till the density in the reservoir has been gradually reduced to the working pressure; before which time the engine, if driven properly, will have reached its proposed distance, when it can be replenished for the next distance of its journey.

This important contrivance consists of a cylinder, A, which will be placed under the foot-plate in large engines, on the top of which is inserted an air-tight piston, B, and a screw-spindle, C, with a spiral spring, D, coiled round it. The spindle enters into a valve-box, E, wherein it carries a slide, which opens and closes a port in the pipe, F, passing from the reservoir into the valve-box, and from it into the regulating cylinder. From this cylinder, A, which maintains the working pressure, two pipes, G, G, branch off to the slide chests of the driving cylinders. The slides are my original invention, patented in 1845. They work over the port and against the slide chest cover, without any back pressure. The pressure is determined by a graduated scale on a slide tube, and the screwing up the spring on the spindle; for, as soon as the air suffered to escape from the reservoir in the regulating cylinder becomes of the working density, the spindle is forced up by its piston, and passes the slide over the port on the valve-box, completely resisting the admission of more air from the reservoir, until the engine's motion attenuates the contents of the regulating cylinder, A, when the spring, not being supported, falls with its spindle and slide, opens the port in the valve-box, admits the regulated supply, and closes again, or so nearly, as to continue the supply of the cylinder equal to the draft upon it, by the expenditure of the two driving cylinders. The instant the set of the spring increases or decreases the working pressure, the velocity of the engine increases or decreases; the velocity of transmission being thereby increased or decreased.



In stopping an engine by shutting the cock, H, of the main reservoir, the quantity in the regulating cylinder, A, is gradually attenuated. Each revolution of the driving wheel, and the momentum of the engine and load, may be arrested by the break, or the pressure may be cut off from the slide chests by closing the cocks, G, G, and the break put on as with steam.

As compressed air loses no power from keeping, engines may stand charged and be started at a minute's notice, neither wasting power, costing anything, nor doing any damage to the engine, which cannot be the case with steam locomotives.

The advantages of compressed air power for locomotion, making the calculations on practical data, consist of—

1. A reduction in the prime cost of locomotives of 20 per cent. or more, arising from air reservoirs, &c., costing less than boilers, tubes, fire-boxes, &c., for which they are substituted.

2. A reduction of one-third the present number, as air engines will run any length of journey without being changed; and not requiring to be inactive in the workshops, so many spare engines will not be wanted.

3. A reduction of three-fourths of the present expense for repairs, as air engines will not be exposed to the destructive effects of intense heat and steam.

4. A vast saving from increased durability, in the ratio of 50 to 1, as air reservoirs will last 100 years or more, and the fair wear and tear will only be on the frame, wheels, springs, &c.

5. A saving of one-third on fuel, by using coal instead of coke at compressing stations, calculated on the usual cost of 3 lbs. of coal per horse-power per hour for working compressing pumps and machinery.

6. A total saving of water, as air engines carry none.

7. At present, cleaning and washing out of steam locomotives is a heavy expense, which may be reduced three-fourths, as air engines will only want outside cleaning, which can principally be performed by the driver and his mate.

8. As the nature and extent of repairs will be very different, and so much less than steamers, workshop expenses may be reduced on a ratio with the economy of the above items, so that it must be evident the savings on prime cost, repairs, and working expenses of the locomotive account, may be reduced one-half.

In the absence of all necessity for attention to the fires in generating steam power, under all the fluctuations of wind and weather, the working of an engine with compressed air is wonderfully simplified; and as the temperatures of excessive heat, with all the difficulties of ascertaining and calculating them and their effects, are removed, and nothing but natural temperatures have to be dealt with, the advantages of compressed air power needs not to be dwelt upon. The strength of air reservoirs, making them securely air-tight at high densities, and the pressures they are capable of sustaining, for the want of practical experience, are very little understood; 100 lbs. per square inch is thought considerable with high-pressure steam, and as explosions occur, and boiler and tubes burst, with pressures not much exceeding 100 lbs., a pressure of 500 or 1000 lbs. per square inch of compressed air in a cylinder or reservoir, can scarcely be entertained as safe. The tests and experiments made with steam as to the strength of materials, and the calculations of the most eminent men made upon them, are totally inadequate to give a satisfactory theory of the sustaining strength of vessels with pressures free from the heat and vapour of steam.

Take, for instance, one of the vessels that were used by the Portable Gas Company upwards of twenty years ago, one foot in diameter, and ⅛th of an inch thick, every one of which was proved to 750 lbs. per square inch, and a proof-plate affixed on each. I have the certificate of my putting a pressure of 1,050 lbs. per inch on one of the vessels, which was far short of what it would bear safely. Calculation and theory are quite at fault when experiments are properly conducted by hydraulic and pneumatic pressures. On bursting one of these vessels, the

pressure could not have been less than 4,500 lbs. on the square inch; and reflecting on this extraordinary resistance, and taking 40,000 lbs. as the tenacity of a square inch of iron, and dividing that sum by 9, for the thickness of the vessel, it gave 4,444 lbs. per inch, which being so near the pressure at which the vessel bursts, must approximate very nearly to the real sustaining strength when the metal is unaffected by the expansion of heat, and the pressure influenced by explosive gases. To ascertain the maximum resistance to internal pressure, I propose the following simple and satisfactory plan:—Make a ring, or hoop, 1 foot in diameter, 1 inch deep, and $\frac{1}{9}$th of an inch thick, of the best iron; turn it to a perfect circle, and fit a number of blocks accurately within the ring, and in the centre of these sectors turn a conic hole 1 inch in diameter, into which insert a mandril accurately fitted. Support the blocks within the ring on a smooth plate with a hole in the centre, making the mandril the fulcrum of a lever; load this balance lever till the pressure from the centre of the blocks expands and bursts the ring of the same thickness as the gas vessel, and we gain sufficient proof of the strength of them. Now, as in a ring of that diameter there are $37\frac{1}{2}$ inches, the question is, should an indicated pressure of *n* per square inch of any fluid be multiplied into the number of inches in the circumference, or should the pressure be taken at *n* on the whole circle? The conical mandril, loaded to 100 lbs., will only give that force to its circumference of 1 inch diameter; and this central pressure on the irradiating blocks will only distribute over the arcs of each block each portion of the mandril forcing them outwards, and the pressure on the ring cannot exceed 100 lbs. When the mandril is loaded to the full amount the metal is capable of resisting, the conditions and effects must be the same; and when the ring bursts, it stretches first throughout the circumference from the distributed pressure, and breaking only with the central density or force. Although a valve, loaded to 100 lbs., shows the density of the contents of a vessel, the propulsive force of the whole mass of elastic fluid is directed to the moveable valve, or bursting point; but if there were 37 valves, the whole of them could not rise simultaneously, but only one would allow it to escape. It therefore appears that the customary method of multiplying the pressure into the circumference is an error in pneumatics, and that the pressure on the whole ring is only as the density.

Cylindrical boilers would sustain the same pressures with steam, were it not that heat separates every particle, while expansion weakens the metal; besides, explosive gases (the force of which cannot be ascertained) create a pressure that bursts them, which simple pressure cannot do. Hence the strength of cylinders for holding compressed air at high densities is abundant and safe. To make them perfectly air-tight, I propose to weld these vessels, and to have as few pieces and rivets as possible, and to tin, electrotype with copper, or coat the inside with any ductile metal or substance, for the purpose of shielding the whole surface, and securing any joints or defects on the inner surface, and also to prevent the infinitely small particles of air, or any other fluid, at very high densities, being forced into, and penetrating among, the particles of the metal of the vessel, which I have found a lining often to prevent completely, giving strength and security.

The principle of expansion can be carried out to perfection by compressed air. It being an expansive power, always of the natural temperature in the reservoir, as soon as it moves the piston, its density must be equal to the resistance; and having no disposition to condense (not being adulterated with heat or vapour), its activity will follow the piston the whole length of the stroke, when, on the return of the piston, it would have to meet the resistance of the contents on the other side; so that, to gain every advantage, it would be necessary to work it expansively, to avoid counteracting back pressure. For instance, if an engine were worked with four atmospheres, or 60 lbs. on the inch, by cutting off at $\frac{1}{4}$ of the stroke, on the piston reaching the end of the stroke, expansion would have attenuated it to atmospheric pressure as it is blown off. At whatever density the compressed air may be worked, the conditions are the same; for in the greatest practical velocities, the increased density of this pure element has an increased power of transmission equal to the increased velocity of the piston. Not being clogged with any vapour, nor liable to condense, as steam does, when not in contact with the water and heat of the boiler, but always being dry, and expansive, and pure, every advantage of the principle of expansion may be embraced in this system.

In a reservoir of compressed air, the propulsive force of the whole body follows the current through all the passages to the induction ports of the cylinders, leaving the quantity, when cut off, that has moved the piston all its expansive force, to carry it to the end of the stroke. Should the density of the current be greater than the power required to overcome the resistance of the piston, the overplus power will give it a speed equal to the density, an attenuation will take place that will equalize the moving force and resistance, which being sufficient to keep the machine in motion, the extra density will not be lost power, but only serve to increase the speed—which extra pressure in the use of steam is blown off at the safety valve. Thus it is the time, and not the speed, that determines the quantity of power requisite for a given load (engine and train included) for a given distance; for if a certain pressure on the piston moves the engine and trains over a mile in *two* minutes, in which time the piston has travelled 150 times, by applying a duplex density, which increases the speed of the piston to 150 in *one* minute, the speed of the engine will be increased, the time halved, but the distance and the power used will be the same, or very nearly so, as it is only applying the requisite power quicker, because the piston cannot wait to equalize the moving density with the higher density of the current supply. With a reservoir of prepared power, the working can be relied on, not being subject to the fluctuations of combustion, artificial temperatures, and the difficulties of steam.

From these considerations, it may readily be seen that the cylinders and piston need not be so large as in the steam system; for as steam attenuates in the passage from the boiler, and under the moving piston, and although it has not time in a locomotive to lose much heat and condense, it has but a limited expansion when disengaged from the boiler—certainly very inferior to the expansion of compressed air, which will always be augmented by the increased temperature of the cylinder (from the friction of the piston) above the natural temperature of the reservoir. Smaller cylinders will be necessary to economise power; and as the pressures on the piston can be increased or decreased to the maximum or minimum resistance occasionally demanded on inclines, or the various loads to be drawn, the expenditure of power and the duty of a line may be equalized, by which acquisition, branch lines, with few and light trains, would cost correspondingly as to power, which would also be the case for working goods, passenger, and express trains.

ARTHUR PARSEY.

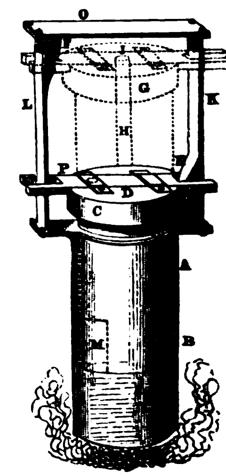
London, January 1, 1853.

SIMPLE ENGINE.—MINE SAFETY-LAMP.

If the following suggestions should merit your attention, I should be glad of the honour of their insertion in the *Practical Mechanic's Journal.*

The first is merely an untried plan of a steam-engine, which has no other claim than that of great simplicity, and may in other respects be very inferior to a common steam-engine; but from its simplicity, and consequent lightness and cheapness, it may, perhaps, in some cases be useful.

A B is the boiler and cylinder, all in one; the lower part, M B, of which part only is filled with water (as shown), and this part being situated in the fire; D C M N is the piston. It is shown by white dotted lines, A B, and also on the opposite side of the drawing. It is also bored through its whole length, so as to form a tube through which the steam may escape when necessary. The top, C D, having a groove in it, is furnished with a slide-piece, E P, which has a hole in it, so that this slide may either close the aperture of the piston, or form a vent for the steam to escape, according to the position the slide may be in. When the part without the hole comes over the tube, it closes the passage, and when the hole comes over the tube it opens it, while two straps secure it in its place. In order, then, that this opening and closing may be effected, a frame, L O K, is attached to the cylinder, and is provided with two cams, or swells, E and F; and the slide having two clasps, embracing the frame loosely, so that when the piston is down, the swell, E, pushes the slide over the tube, and thus closes it; and when the piston reaches the top, shown by the dotted lines, F, I, G, E, P, H, the slide is pushed by the swell, F, so that the hole comes over the tube. When the piston is down, then, the tube being closed, the steam forces it up till it comes to the top; the swell, F, then acting on the slide, opens the aperture, so that the piston descends by its own weight for a new stroke, the aperture being closed during the whole ascent, and open during the whole descent.



It may appear that a great waste of fresh steam is caused by allowing it to escape while the tube is open; but this seems not to be the case, because we need not let more steam escape than is necessary in order to let the piston descend; and, for this purpose, *some* steam *must* be let out—whether this is new or old steam does not much matter; but it stands to reason, that the escaping steam must be the old, and not the new, which cannot escape although the passage is open, because, in order to do so, it must penetrate the old steam; and there seems no reason why it should do so, and overtake the latter.

The piston may be loaded to hasten the descent; and, if preferred, there may be two cylinders—the pistons being connected together by a beam, so that the rising of the one piston would sink the other, and in this case no loading of the piston would be required.

A plan might, perhaps, be adopted so as to omit the whole of the apparatus described for the escape of steam, by cutting notches, M, N, in the bottom of the piston, so that, when it has risen to a certain height, it would admit the steam to escape through them; but the stroke would then be very limited, and the plan very inferior to the former one.

The second suggestion is also an untried plan. It is for the prevention of explosions in mines. It consists in having a lantern of glass, the glass being one or two inches thick, and protected with wire, if necessary. The lamp to be entirely closed, so that no air can enter and no gas escape, excepting through a tube shaped like a siphon, and laid flat on one side of the lantern—the lower part containing water, so that whatever air enters or leaves the lantern must pass through the water, and thus prevent its taking fire. But whether the air would have the power to force itself through the water remains to be tried. I do not

pretend to know this, yet think it very probable, and to be worth a trial. Nor do I know whether the air which enters and that which leaves the lantern could go through the same tube, or whether two tubes might not be required.

London, 1853. LEWIS GOMPERTZ.

ON A NEW PROCESS FOR MENTAL MULTIPLICATION.

Multiplication has been treated of by every writer on arithmetic for many successive centuries; and although hardly anything has latterly been added to the stock of knowledge previously possessed on this subject, it would nevertheless be astonishing if, at the present time, anything remained to be written on this branch of arithmetic which would interest any of us, either from its novelty or importance. I contrived what I have now to explain about a twelvemonth ago, since which date I have frequently gone over the process before individuals pretty well versed in arithmetic; but none of them have had the slightest idea of how the result was obtained. As I did not satisfy their curiosity, I may presume that an elucidation of the principle will be new to the majority of the readers of this *Journal.*

I shall best explain the process by an example; but first I will consider ordinary multiplication, and the principle on which its operations are based:—

```
   1234567 = n.
      4567
   ───────
   8641969 = 7 × n.
  7407402  = 60 × n.
 6172835   = 500 × n.
4938268    = 4000 × n.
──────────
5638267489 = 4567 × n.
```

But, by the new method, we can multiply by several figures at the same time, only writing the multiplicand, the multiplier, and the product; and the principle involved in the process is that in the above example:—$1234567 \times 4567 = (7 \times 7) + 10$; $[(7 \times 6) + (6 \times 7)] + 100$; $[(7 \times 5) + (6 \times 6) + (5 \times 7)] + 1{,}000$; $[(7 \times 4) + (6 \times 5) + (5 \times 6) + (4 \times 7)] + 10{,}000$; $[(7 \times 3) + (6 \times 4) + (5 \times 5) + (4 \times 6)] + 100{,}000$; $(7 \times 2) + (6 \times 3) + (5 \times 4) + (4 \times 5)] + 1{,}000{,}000$; $[(7 \times 1) + (6 \times 2) + (5 \times 3) + (4 \times 4)] + 10{,}000{,}000$; $[(6 \times 1) + (5 \times 2) + (4 \times 3)] + 100{,}000{,}000$; $[(5 \times 1) + (4 \times 2)] + 1{,}000{,}000{,}000$; $(4 \times 1) = 5638267489$.

In performing the operation by this method, it is best to arrange the multiplier and multiplicand as under, having the last digit of the multiplier immediately under the first of the multiplicand:—

```
   1234567
4567
──────────
5638267489
```

$7 \times 7 = 49$, 9 and carry 4; $(7 \times 6) + 4 = 46$, $+ (6 \times 7) = 88$, 8 and carry 8; $(7 \times 5) + 8 = 43$, $+ (6 \times 6) = 79$, $+ (5 \times 7) = 114$, 4 and carry 11; $(7 \times 4) + 11 = 39$, $+ (6 \times 5) = 69$, $+ (5 \times 6) = 99$, $+ (4 \times 7) = 127$, 7 and carry 12; $(7 \times 3) + 12 = 33$, $+ (6 \times 4) = 57$, $+ (5 \times 5) = 82$, $+ (4 \times 6) = 106$, 6 and carry 10; $(7 \times 2) + 10 = 24$, $+ (6 \times 3) = 42$, $+ (5 \times 4) = 62$, $+ (4 \times 5) = 82$, 2 and carry 8; $(7 \times 1) + 8 = 15$, $+ (6 \times 2) = 27$, $+ (5 \times 3) = 42$, $+ (4 \times 4) = 58$, 8 and carry 5; $(6 \times 1) + 5 = 11$, $+ (5 \times 2) = 21$, $+ (4 \times 3) = 33$, 3 and carry 3; $(5 \times 1) + 3 = 8$, $+ (4 \times 2) = 16$, 6 and carry 1; $(4 \times 1) + 1 = 5$.

In each step of the process commence with the last figure of the multiplier, and the figure of the multiplicand immediately preceding that last placed in the product, until the product extends beyond the multiplicand, when the remaining steps commence with the figure of the multiplier immediately preceding that last placed in the product, and with the first figure in the multiplicand, using the digits in the multiplier always from right to left, and those in the multiplicand always from left to right; each step in the process stops only when the digits in either the multiplicand or multiplier are all used.

I do not recommend this method for the multiplication of very long numbers, but it is very useful for many operations at present considered beyond the powers of mental multiplication, and in all cases when a line of figures are to be multiplied by two or even three figures, and in squaring or cubing numbers below one thousand.

I shall be very glad if any observer can either improve on this method, or give us one of his own, by which any of these tedious operations may be shortened, without the use of tables of artificial numbers.

Cartsdyke Foundry, Greenock, Feby. 1853. J. M'F. G.

CONSTANT MULTIPLIERS FOR EXPEDITING AND VERIFYING CALCULATIONS.

There are certain numbers, constant multipliers, with which we are all well acquainted, used hundreds of times each day by persons engaged in mechanical calculations. Any improvement on the method of using these numbers, which would either shorten the operation, or give greater confidence in the result, would, I am sure, be gladly adopted; and I therefore wish to point out such a system of operation, consisting in separating the multipliers, not into their factors, but into their component parts, the sum of which gives the multiplier.

Instead of explaining the operation verbally, I shall show how it is adapted to three of our most useful multipliers,—those for finding the circumference and the area of a circle, and that for the solid content of a globe. These resolve themselves into the following component parts:—

```
1·           1·        1
2·            7        25
 14           7        26
  14          14        26
   2           14        1
──────       ─────     ─────
3·1416       ·7854     ·5236
```

The manner of using these multipliers is as follows:—

```
32927· × 3·1416
65854                 1st line × 2
             3
 460978     5×6       2d line × 7, two places out.
             3
   460978             repeat 3d line, two places out.
     65854            2d line repeated below the last.
──────────
103443·4632
```

Here we have two multiplications only; the decimal place is found as in the ordinary method.

```
32927 × 7854
────────
230489                1st line × 7, one place out.
             3
 230489     5×6       repeat,            do.
             3
   460978             last line × 2,     do.
     460978           repeat,            do.
──────────
25860·8658
```

Here we use the same figures as in the last for multipliers, 2 and 7. In this case we do not add in the multiplicand.

```
32927 × ·5236
0823175               1st line ÷ 4, two places to left.
 856102      8
            5×7       add the 1st and 2d lines.
             8
   856102             repeat 3d line, two places to right.
    32927             repeat 1st line, one place to right.
─────────
172405772
```

Here we have only a division and two additions, and in neither of the examples have we any more lines of work than in the ordinary method.

J. M'F. G.,
Cartsdyke Foundry.

Greenock, Feb., 1853.

HINTS ON FLAX-GROWING.

The growth of flax is now deservedly attracting general attention. It is to be hoped that the consideration now given to it may atone for past neglect, and as we can only progress by a combination of experiences, I shall be glad to aid in the movement by contributing mine. The system of culture which I find most profitable—giving no trouble in weeding—is this: I plough old lea-grass on or about the 15th of March, not more than five or six inches deep, and turn the sward well down, and from the 1st to 5th of April (as weather permits) I sow half the usual quantity of guano per acre, with the flax seed, giving it a slight harrow, and rolling all down firm.

The special advantages of this system are—that the flax requires no weeding, and the crop of grass which follows is superb at the fall of the year. It is the best possible feeding for sheep, and if clover and grass seeds are sown with the flax, the crop of rye-grass and clover the following year, is superior to that of wheat or oat stubble. Flax sown after potatoes or turnips involves a large outlay in weeding in nearly every case.

Erins, Lochfine, Dec. 1852. WM. FORLONG.

THE ORDNANCE SURVEY OF SCOTLAND.

Allow me respectfully to draw your attention to the accompanying remarks on the Ordnance Survey of Scotland, by Sir R. I. Murchison.

I understand that efforts are at present being made, both in Glasgow and Edinburgh, to induce the government, in preparing the maps of certain districts of the country, to revert from the scale of one inch to the scale of six inches to the mile. After perusing the accompanying extract from the address of the accomplished geographer and geologist above referred to, I trust you will concur with me in thinking that, should such efforts prove successful, it will be to the manifest disadvantage of the country at large; as tending to retard indefinitely the completion of a trustworthy map of Scotland, the want of which has been long felt a very serious inconvenience by a large portion of the mercantile and scientific world. Sir R. I. Murchison may well say—"the six-inch survey is, in truth, much too cumbrous for consultation in county matters;" for the extreme measurement of a map of Lanarkshire on that scale, would be about *twenty-eight* feet by *seventeen* feet; and a map of the whole country, excluding the Orkney and Shetland Islands, would be about *one hundred* and *forty* feet long; while, on the *one-inch* scale, Lanarkshire would only be about four feet four inches long, and Scotland a little above *twenty-three* feet; sufficiently large to admit of all the details being introduced that are required for the general purposes of the community. Besides the disadvantage of cumbrous size—as the publication of the six-inch survey would not be completed till a period approaching, if not beyond, the year 1900—there will be little chance, should that scale be extensively adopted, of any of us of the present generation ever seeing a complete map of Scotland. But the publication of the *one-inch* scale, on the other hand, if left to be proceeded with uninterruptedly, would be completed soon after the year 1860.

Should you agree with the views expressed by the President of the Royal Geographical Society, I hope you will employ your influence in opposition to any movement that may be made to upset the recommendation of the Committee of the House of Commons, that the whole annual grant of money "should be exclusively devoted to the completion of a real map on the scale of one inch to the mile."

Glasgow, January, 1853. W. G. Blackie.

Extract from the address at the anniversary meeting of the Royal Geographical Society, May 24, 1852. By Sir R. I. Murchison:—

"In referring you to the Report of a Committee of the House of Commons, appointed last session to inquire into the state of the Ordnance Survey of Scotland, I am happy to state that the more active measures for the construction of a general map of that country, which I have been urging for eighteen years, have at length been adopted. The publication of maps on a six-inch scale, which had been carried out for the whole of Ireland, at a great expense, had been already applied to two southern counties of Scotland, with the addition of 'contour' lines, when it was ascertained that with such a process, and at the then rate of outlay, *more than half a century would elapse* before North Britain could have any map!

"The British Association, at my instigation, first roused attention to this subject in 1834, and so effectually revived it in 1850, that the above-mentioned Committee of the House of Commons was at length appointed. Their Report has happily procured a grant of £25,000 per annum for the Scottish survey, accompanied by a strong and distinct recommendation that this sum *should be exclusively devoted to the completion of a real map, on the scale of one inch to the mile*. If this suggestion be complied with, and the publication of a six-inch survey be suspended until the general map be finished, though the country be really surveyed on that scale, all Scotland will be usefully mapped in ten years. In the Report of the Committee of the House of Commons—for which we are specially indebted to its intelligent chairman, the Hon. Francis Charteris—you will see how the opinions of the eminent civil engineers, Stephenson, Brunel, and Locke, agree with those of the members of the Committee, in the earnest recommendation of the speedy publication of a map upon a one-inch scale for general purposes.

"In fact, the Committee could not avoid being strongly impressed with the declaration of a previous Parliamentary Committee, appointed to inquire into the state of geography in Ireland, who reported that, after an expenditure of £850,000, and the publication of a complete six-inch survey, the sister country was still without *a map*. The six-inch survey is, in truth, much too cumbrous for consultation in county matters; and though there are certain tracts of mining-ground where it is unquestionably of value, it is too small for many detailed purposes of the engineer and farmer, for most of which a double or even a treble scale is required.

"Rejoicing, as I did, in the decision of the House of Commons in reference to Scotland, and also in learning that a sufficient sum had been granted to complete the map of all Scotland on the scale of one inch, in the space of ten years, I have recently been grieved to hear that local petitions from the south of Scotland have been got up to procure a *publication* of the six-inch survey. I have been told that some of the persons so petitioning are acting under a misapprehension, in thinking that each proprietor will thus obtain a plan of his estate. But even if it were so (the scale, however, is much too small for plans of property), what sort of patriotism is it, I ask, which, for such considerations, should sacrifice the interest of Scotland at large, and possibly postpone, for half a century, the issue of any real map of the whole country? Let the Highlanders and their chiefs unite as one man against this injustice to their region, which of all others in North Britain, will most signally develop the beauties of topography on a good and useful general scale."

POSITIVE AND NEGATIVE SLIP IN SCREW-PROPELLERS.

You are afraid that I have "assumed" too much. Excuse me if I return the compliment, which I do not deserve. You "assume" (on what principle it would be difficult to tell) that the resistance to the screw is the same at all velocities; whilst the facts prove that it varies as the square of the velocity. If, therefore, a screw develops a resistance of 3,000 lbs. at 100 revolutions per minute, *the same screw* certainly develops a resistance of only 750 lbs. at 50 revolutions, and of 1274·6 lbs. at $65\frac{7}{11}$ revolutions per minute. How can an equal pressure of steam produce a higher velocity, the pressure and the velocity depending upon each other?

I cannot pretend to say what you mean by "slip." I mean that which I have spoken of in my letter, viz., the difference between the pitch of the screw, and the forward motion of the ship, for one revolution of the screw.

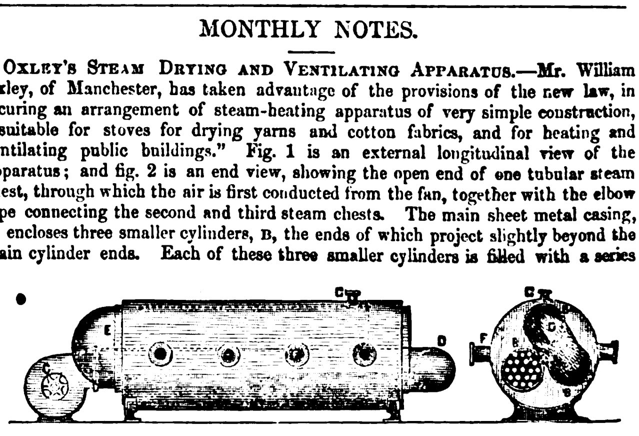
London, Feb., 1853. R. Bodmer.

[Our correspondent must excuse us for the application, but he does remind us that "drowning men catch at straws." We admit the existence of a little looseness in the statement of our argument last month; but this does not at all interfere with the point in dispute. In constructing his case, he supposes "a force equal to 750 lbs. acting at the circumference to turn it round." Now, what we meant to say in answer was, "*supposing* that at a somewhat higher velocity there would still be 750 lbs. acting at the circumference, the screw would make $65\frac{7}{11}$ revolutions, because at that rate the resistance would just balance the acting power." Any one knows, that at the higher velocity the same conditions of engine would not develop the 750 lbs. acting at the circumference of the screw; and we added, "of course, the screw will make something under 65 revolutions."

Further, he uses the phrase "develops a resistance" where, in his previous letter, he talked of "a power acting at the circumference;" thus confounding the acting power with the resistance met with, the comparison of which is the very thing aimed at. Perhaps he means to say that, in the case of negative slip, at a given velocity the screw develops a greater axial resistance than is met with by the ship. This may be quite true, but it is only stating the fact in different terms. It is certainly no explanation; for we are still at a loss to know *why* the screw should do so.—Ed. P. M. Journal.]

MONTHLY NOTES.

Oxley's Steam Drying and Ventilating Apparatus.—Mr. William Oxley, of Manchester, has taken advantage of the provisions of the new law, in securing an arrangement of steam-heating apparatus of very simple construction, "suitable for stoves for drying yarns and cotton fabrics, and for heating and ventilating public buildings." Fig. 1 is an external longitudinal view of the apparatus; and fig. 2 is an end view, showing the open end of one tubular steam chest, through which the air is first conducted from the fan, together with the elbow pipe connecting the second and third steam chests. The main sheet metal casing, A, encloses three smaller cylinders, B, the ends of which project slightly beyond the main cylinder ends. Each of these three smaller cylinders is filled with a series



of small metal tubes, extending longitudinally through, and made tight at each end. The space between the tubes in the small cylinders is filled with steam, and the air to be heated thereby is conveyed by a fan, C, and conducted, first, through the tubes in one of the small cylinders. After passing along these tubes, the partially heated air is guided by an elbow piece, D, into the opposite ends of the tubes of a second small cylinder. From this cylinder, the air current is conducted by another elbow, E, at the entrance end, into the last cylinder, whence it is finally discharged into the space between the three small cylinders, and the large encircling cylinder. This space forms a reservoir for the heated air, whence it is drawn off as required. In the arrangement before us, the heated air escapes by the lateral pipes, F, whilst the heating steam is supplied by the pipe, G, at the top. Steam-heated air is getting rapidly into favour amongst manufacturers, bleachers, and dyers, as it is found to be far superior to any other medium for heating and drying, from its imparting a mellow softness to the goods, whilst it preserves dyed goods in all their brilliancy.

Prolongation of Heath's Patent "Improvements in Steel."—Mrs. Heath's application for an extension of her late husband's patent, after having been under the consideration of the judicial committee of the Privy Council for some time, has resulted in a seven years' extension. Mrs. Heath's evidence went to show, that whilst large sums had been expended in experimenting and in making articles of cutlery, not more than £200 had been received in the shape of royalty. In giving judgment, Dr. Lushington said that their lordships were of opinion that the invention possessed very considerable merit. The alteration which the inventor had introduced in the employment of oxide of manganese with carbonaceous matter, instead of carburet of manganese, did not materially detract from the original invention, and their lordships were disposed to advise her Majesty to continue the patent for seven years. Of course, their lordships, in so doing, did not express any opinion on the validity of the patent—a question now pending before the competent tribunal. In the event of the decision being adverse to the patent, the renewal will fall to the ground.

New Angle Iron for Ship-Building.—Since we first made mention of Messrs. Sutton & Ash's "Water-space Angle Iron" in our December part, we have found that it has been tried and extensively adopted for ship-building purposes. Messrs. Earle, of Hull, and Messrs. J. W. Hoby & Co., of Renfrew, for instance, have already used it extensively beneath the sole-plates, and for stiffening the frames beneath the boilers and engines of iron steamers. It is also found to afford great facilities for attachment to the floor-plates and reverse L irons, and is, besides, a good stiffening iron for bulkheads, and other work of the same class. Indeed it promises to be of very important service in iron ship-building.

Mining Legislation.—A combined remonstrance on the present inconsiderate system of conducting mining operations, is shortly to be made to Parliament by an extensively signed petition from the pitmen of the North of England. This document commences its pleadings, by a reminder on the subject of the excessive loss of life constantly going on below ground, and adds:—"That, from the legislative and other official investigations into the causes of such destruction of human life, and from the experience and observation of your petitioners themselves, it is demonstrable that such extensive loss of life is due to incompetent management on the part of many of the proprietors and managers of mines, and the want of a due regard to those principles of safety which science has called into existence, and upon which the health and lives of the workmen depend." On the *Mines Inspection Bill*, which provided that six inspectors should take charge of the whole of the British mines, the petition bears with some severity in asserting that the great body of miners has been in no way assisted by the enactment, as the number of fatal accidents has actually increased since the passing of the Act. The limited number of the inspectors shuts out this legal provision from any serviceable effects. The late increased loss of life, indeed, called another parliamentary inquiry into existence. This resulted in good as far as it went; but a mistake was made in the non-examination of any operative miners, a proceeding which would have thrown a fuller light on the nature and necessities of the case, than can be otherwise obtained. The report of the inspector for the North of England district, is laid hold of by the petitioners, as impressive of the necessity of immediate attention to the miner's wants, as the report in question states that the primary cause of the explosions of fire-damp at the Hebborn, Washington, and Killingworth Collieries, was an inadequate supply of air; the inspector indeed asserting, that had he examined the pits previous to such explosions, he would have advised the increasing of the supply of atmospheric air to such districts, and such other amended arrangements as would have prevented the said explosions, and thus saved the loss of life occasioned thereby. The petitioners therefore pray for the amendment of the *Mines Inspection Bill*, and that a board of control or supervision may be appointed; that the number of inspectors be increased; and that sub-inspectors be appointed, with powers to the inspectors to suspend operations in all dangerous works. Also, that proper air-ways (intake and return passages) be made in all mines, and that instead of two passages as at present, there shall be at least three in each mine, one to be quite unobstructed by curves or the transit of the mine produce. Great anxiety is naturally felt on this point, because many explosions, such as the Washington one for example, are due to the falling in of the roof, thus cutting off the air-way. It is also demanded that all mining officials be examined as to fitness, just as is the case with mariners; and a six hours' bill for all boys under 14 years old, is suggested as the best means of fostering a more enlightened race of miners. Where fatalities do occur, it is proposed that a special coroner be appointed for their investigation. The petition is earnestly and carefully written, and as it has met with strong support, it is to be hoped that its arguments will meet with that legislative attention to which such a movement is so well entitled.

Coal and Iron Mining in Ireland.—Ireland's industrial resources have just now received an extensive accession of developing force, in the discovery of vast coal fields and ironstone beds in the county of Leitrim. About the beginning of 1852, a Scotch company, attracted by the appearance of the district, commenced operations for the production of pig-iron, at a spot 3 miles from Drumkeerin, 6 from Lough Allen, and 9 south of Manorhamilton, in a district called Creveled. Their mineral take extends to the margin of Lough Allen, but the openings are, so far, confined to the place we have indicated, showing however a very extraordinary mass of mineral wealth already. The coal crops out in various places in two beds close to each other, and 2½ and 3 feet in thickness. Near these beds are two strata of ironstone, one in balls, varying from the size of an orange to 18 inches in diameter. Both kinds are well placed for access, and the quality is said to be equal to any stone in the kingdom, being carbonate of iron, two tons of which, in the calcined state, make one ton of pig-iron. The coal is a brilliant black of excellent coking quality, and indicating only 5 per cent. of sulphur. The company is just now getting to work. They have a good road to the works, where there is a blast furnace now blowing in, with a 100 horse engine. The minerals can be brought to the furnace for 3s. a ton, and with the many other advantages of the place, iron is expected to be made as cheap, or cheaper than anywhere in Scotland or England. Not far from this promising scene, are the Arigua Company's Works. These are unfortunately stopped by a workmen's combination—a state of matters much to be regretted, as the ore is said to be first-rate.

Photographic Exhibition.—It is suprising to hear of the number of little infants that are being "reared" around us just now, and still more so to know how very much these little infants exceed all that our fathers have told us of our own high inheritance of power. *Everything* of real importance, around us and about us, is stated on all sides to be but in its infancy, and we poor puny growth of the centuries are doomed to see our handicrafts, of all descriptions, actually elaborated with far greater precision, skill, and steadiness, than we could perform them, and that too by means of instruments, literally as common as sunlight. The age of miracles has not passed, if, as we must, we judge a miracle to be a thing to be wondered at. A few days over ten years ago, and Photography lay deeply buried in the bowels of creation, among Nature's "great unknowns." A geologist of a peculiar mould arose, took up his spade, and in digging for something else—as has always been the case, and always will be we suppose—hit upon that new and singular action of part of the material universe, which was presently caught tight hold of by Mr. Fox Talbot, and confined like an exotic animal, of as yet uncertain bearing, within the confines of the snug little cage of a patent. On did this gentleman plod, and plod, and plod again, until at length the great fact came to be appreciated, that the creature he had discovered was but a young one of its kind—in present language an infant—for in his mind's eye he saw giants among its posterity, as he knew giants of mighty strength and skill to be its immediate ancestors. He worked away quietly in his solitary den, enclosed secretly against all intrusion, by the "locks, bolts, and bars" of parchment and great seal. But, notwithstanding this, his new discovery had many private visitors to view its singular properties, and these getting buzzed about from one to another, and another, and so on, why, what could Mr. Talbot do?—not many would have done it, we must say; but be it ever spoken to his utmost honour—and he ennobled himself by the act—he opened the bars of the cage, flung its patent rights into the fire, and said, "There, work away my masters; I love art and those who love art; now then improve away as fast as you can." The suggestion is being acted upon in a very becoming manner; as the first Photographic Exhibition, just over at the Society of Arts, London, proves. We can assure our readers that it was a sight to see. With scarcely an exception, not pictures, but the things themselves they were designed to represent, hung on the walls, being visible apparently as through chinks and crannies of some building near. The minuteness—more than the hints for still greater things—which many, and the fidelity which all of the specimens exhibited, were startling, even to a manipulator in the art; while the great variety of objects represented was calculated to please lovers of as great a variety of subjects. The Society of Arts has done well to get up this little Exhibition, which is in itself not one of the least results of the great one; and a well printed and papered catalogue, at a barely remunerative figure, incorporating six quarto pages detailing the history of the art and its methods, and an appendix of very excellent notes, is not calculated to lessen the honour due to Mr. Solly, the new Secretary, who, acting on the original suggestion of Mr. Joseph Cundell, has been mainly instrumental in bringing the matter to so successful an issue. Our space forbids us taking especial notice of the specimens in detail; one, however, we cannot refrain from mentioning, and the bare mention of it will suggest the immense importance this almost new art may be of by-and-by. This article stands in the catalogue as "Larva of Insect" photographed by P. Pretsch, by the paper process, and exhibited by Mr. T. Bagster. It is in fact an unique and remarkable specimen of a magnified view of the skin of a caterpillar, as seen through a powerful microscope. Since going to press, we hear that colours have been fixed by the process.

Silk-Growing.—Since the successful experiments of Mrs. Whitby* on the growth of the silkworm, for the production of its valuable textile material, in the Midland counties, little has been heard of the matter in this country. But our continental neighbours have become so keenly sensible of the industrial importance of fostering this branch of original production, that they have lately tested the truth of the assumption, that silkworms cannot thrive in our northern latitudes. The first attempts to establish this branch of industry in the north, were made by French Protestant refugees in the district of Wurtzburg in 1594, and they were encouraged by the Prussian Sovereigns. In the middle of the seventeenth century, the ramparts of Petz and the environs of Frankfort on the Oder were planted with mulberry trees, and in the following century Frederic the Great caused plantations to be made at Cœpnik, Potsdam, and in the immediate vicinity of Berlin. Since 1821 the production of silk has become considerable, not only in Prussia, but in the other States of the Zollverein; the annual production is at present several thousand pounds. In quality it is remarkably white, and finer than that in the southern countries; and Berlin manufacturers say, that if enough of it could be obtained, they would not apply to the producers of Lombardy. From Berlin and Potsdam the cultivation of mulberry trees gradually extended to Silesia and Hanover. It is schoolmasters who chiefly occupy themselves with it—one of their body having, in the eighteenth century, commenced it as a means of adding to his income; and some of these persons now gain from 20 to 80 thalers (75f. to 300f.) annually. Several of the German Governments encourage the production of silk by granting premiums, and causing societies of patronage to be formed. A short time ago, the Minister of Commerce recommended that the sides of all the railways should be planted with mulberry trees. The King of Wurtemberg has caused the French translation of the Chinese treatise on the breeding of silkworms to be translated into German, and to be extensively circulated at Dresden; M. D. Carlowitz, one of the Ministers, has published a work on the subject; and at Munich, the Queen, the Royal Princesses, and the principal ladies of the aristocracy, patronise societies for encouraging it. In the Grand Duchy of Baden, the roads and sides of the railways have been planted with mulberry trees, and in the village of St. Ilgen, near Heidelberg, the breeding of worms has been carried on, during the last 12 years, on an extensive scale. Austria, on its part, is sparing no pains to increase its production, which already amounts to about 100,000,000f. annually—one-half coming from Lombardy alone. On the military frontier of Turkey, a garden of mulberry trees has been established in every village, and the military colonists are encouraged to extend the cultivation. At Prague, the fosses of the fortifications have been planted with mulberry trees, and orders have been given that such trees shall also be planted by the side of all the railways in the monarchy. Not long ago, it was proposed that we should plant our railway slopes with vines. Why is not the experiment tried in our southern counties, to begin with? and why not add mulberry trees?

* Page 212, Vol. II., *Practical Mechanic's Journal.*

Johnson's Corrugated Chain Shutter.—This is an American modification of the wrought-iron lath shutters, now so extensively used in this country for shop and office windows, instead of the old inconvenient system of separate wooden shutters. The laths, or iron strips, of which the shutter is composed, are curved somewhat to the shape of an S, a form to which we have given the name "corrugated." The two parallel edges of each piece are curved round in opposite directions, the individual pieces hooking together in a chain—so that the entire web of the shutter is made up without any hinge-pieces, or connecting-pins of any kind, the curved junction-edges being engaged by sliding them into gear longitudinally. By this means a joint is made, of such a kind that the shutter may be wound round a roller, hung at the top of the window-frame, in the interior of the building. One end of this roller carries a small pulley, over which a counter-weight is hung, to balance the pendant shutter's weight—whilst a second pulley, at the opposite end, is for an endless driving-chain, worked by a small winch-handle near the floor, for winding up or lowering the shutter. This shutter has a handsome appearance, whilst the curved or corrugated principle, on which the strips are formed, is an obvious means of superior strength. It has been but recently introduced here, after a very extensive adoption in the principal American cities.

Railway Working Costs and Rolling Stock.—The total mileage worked by the London and North-Western Company is 903½ miles, and the average cost of working stock is £2328 per mile. In 1845, the total mileage worked by the Company was 303¾ miles, and the average cost of working stock was then £2656 per mile. The last return of working stock shows, that on the 31st of December last, the Company had 619 locomotive engines and 614 tenders, 1 state-carriage, 582 first-class mails and composite carriages, 569 second-class and 355 third-class, 24 travelling post-offices, 278 horse-boxes, 242 carriage-trucks, 228 break and parcel vans, 28 trucks, 8502 goods waggons, 232 sheep-vans, 18 trolleys, &c., 1155 crib-rails, 5150 sheets, and 162 horses. The total cost of the working stock on the 31st of December, was £2,315,408. On the London and South-Western, the consumption of coke during the half-year has been 9165 tons, being at the rate of 19 lb. per mile, and is less by 1036 tons, or 4·6 lb. per mile per engine, than the consumption of the corresponding period of the year 1850, notwithstanding the mileage has been greater by 111,510 miles.

Norton's Projectiles.—Captain Norton successfully tested his hollow, expanding, elongated iron shot, on the 29th January last. This shot contains its own charge, which, in this experiment, consisted of two drachms and a half of Hall's gunpowder. The base of the shot was covered with a piece of thin calico, well greased. The bore of the small cannon used was that of the military musket, and the shot weighed nearly two ounces, being an inch and three-quarters in length. After being fired, the shot could not be made to re-enter the cannon, even without the piece of calico; thus fully establishing the fact, that hollow *malleable* iron shot will expand by the explosion of the cartridge within it. The percussion appliance consisted of a tube of steel, like that of a steel pen, being the third of an inch in length, and having a military percussion-cap, without the leaf, fitted on one end. This was filled with gunpowder, and covered with thin gutta percha. It was inserted in the base of the cannon, and ignited when struck with a mallet, the fire perforating the calico, which was stretched over the hollow part of the shot, like a drum-head. Captain Norton's improvements are now beginning to command attention in the high quarters of the state.

Science in France.—France has worthily earned her high position, in the perfection of arts and sciences, by the encouragement and facilities which she furnishes to students of all nations. Her liberality is of no selfish character. She aspires to be the Minerva of nations, and reaps her reward in the tacit acknowledgment of her claim, by the multitudes that flock to her shrines of learning, or light their lamps at her altars. Toward genius, France is thoroughly democratic. Nowhere is intellectual worth more ardently welcomed and more richly rewarded. Its source is not questioned, merit is the sole criterion. The consequence is, that in every department of knowledge she has an accumulation of experienced and cultivated intellect, ready to serve her in those points which render a nation illustrious in the eyes of mankind.—*Parisian Sights and French Principles, seen through American Spectacles.*

Thomson's Rain-Tank and Cess-Pool.—To the paper on Mr. Thomson's "rain-tank" in our December part, we may here add a few lines to point out an additional feature of originality in that contrivance. In all previous designs of this class, it is found that no sooner is the impure water admitted, than it is made to pass through the filter bed, with which it is never again brought into contact, however long it remains in the tank. But in Mr. Thomson's tank, the whole of the pure water remains in contact with the charcoal stratum, with the exception of about a gallon held in the concentric basin; and however small a quantity may be drawn off, not a drop more can be received into the basin, until it is united by a fresh stroke of the pump. In the common cess-pool, the inlet and outlet pipes being straight, it follows that, whenever the deposited mud reaches the level of the discharge duct, the pit will retain no more, and all that then comes in by the inlet must pass down the drain. Mr. Thomson removes this evil by bending the inlet passage, so that it invariably chokes before the mud arrives at the level of discharge. Thus the trap is rendered self-indicating, tells its own tale of repletion, and calls for its necessary clearing out.

French Line of Transatlantic Steamers.—The French government is at present occupied with the projected consummation of Thiers' original scheme of a line of French Transatlantic steamers. When the subject was first discussed, the several ports of Marseilles, Havre, Nantes, Bordeaux, and Cherbourg, all claimed the honour of being selected as the station. The government choice has fallen on Cherbourg, and the old land conveyance company, known as the "*Messageries Nationales*," has chivalrously turned its attention to maritime affairs, and has proposed to undertake the entire control of the fleet. The different services will, according to the tender of this company, be organized as follows:—From Cherbourg to New York—five vessels of 1,000 horse-power each, the fifth to remain in reserve; departures twice a month; speed, 11 knots an hour; length of passage, 11 days. From Cherbourg to the Antilles and Mexico—five vessels of 500 horse-power each; departures twice a month; run from Cherbourg to Martinique, 14 days. From Martinique, branch lines of communication by steamers of 250 horse-power, to run to Guadaloupe, Vera Cruz, New Orleans, Cuba, St. Domingo, Grenada, Cayenne, &c. From Cherbourg to the Brazils—three vessels of 800 horse-power each; departures once a month: run, from 20 to 21 days. These vessels to call at Lisbon, Madeira, the French establishment of Goree on the coast of Africa; and from Rio Janeiro additional vessels of 250 horse-power to run to Montevideo and Buenos Ayres. In all 21 vessels, giving a total of 14,500 horse-power. This company expects the large annual government subsidy of £40 per horse-power for the New York line, and £48 per horse-power for that between France and the West Indies and Mexico. This difference in the two amounts is said to be necessary from the presumed increased wear and tear of the latter vessels, which would be at sea on an average 175 days per annum, whilst the former line would only have an average of 140 days. If the proposed conditions are accepted, the government will have a tax of between £600,000 and £700,000 upon it for 20 years. Although we may afford to smile at the idea of elevating the non-commercial but warlike port of Cherbourg into anything like our great steam-ship stations, yet it is plain that the French undert aking, by instilling a new element of rivalry, will do some good to ocean navigation at any rate. The emulative trials of Great Britain, America, and France, will cause much additional interest in the great question of ocean steaming.

Iron Warehouses and Dwellings.—A correspondent, who writes to us from Perth, with suggestions as to furnishing details of iron buildings, will find that we have been beforehand with him in the preparation of our illustrated leading article in the present number. We now add here some further particulars, to which he has directed our attention. As regards the weight and measurement of the packages, comprising an iron building when made up for shipment, very much naturally depends on the particular system of construction employed; but the following may be considered as approximate data, the erection being packed, ready for going on board ship:—

	Tons.	Cwt.
A dwelling-house, of corrugated iron, 17 feet × 13 feet, and 8 feet high to the eaves, with wooden foundations, doors, windows, shutters, gutters, and down-pipes—that is, a complete shell—about	2	0
The same, with the addition of floor, linings, and divisions—about	3	10
A dwelling-house, of corrugated iron, 27 feet × 22 feet, two stories, eight rooms, complete, with floor, linings, and divisions—about	20	0
A warehouse, 60 feet × 24 feet, a complete shell, of corrugated iron, exclusive of floor, linings, and divisions—about . . .	12	0
A warehouse and dwelling, of corrugated iron, two stories, as shown in our plate 118, with floors throughout, and linings and divisions to the dwelling, ...	35	0

An idea of the comparative cost of iron and wooden structures may be formed from the fact, that a cottage, 17 feet × 13 feet, divided into three rooms, without floor or linings, will, in iron, cost about £70; whilst a house, of the same dimensions, may be made in wood for £40. It must, however, be remembered, that iron structures afford protection from the assaults of depredators; whereas, no such security can be expected from a wooden structure.

PROVISIONAL PROTECTIONS FOR INVENTIONS
UNDER THE PATENT LAW AMENDMENT ACT.

☞ When the city or town is not mentioned, London is to be understood.

Recorded December 14, 1852.

1052. William Irlam, Manchester—Improvements in railways.

Recorded January 1, 1853.

2. Henry Bentley, Spilsby—Invention of vulcanised india-rubber springs for trousers and breeches, with instructions to adjust the same.

Recorded January 6.

35. Edme A. Chameroy, Paris—Invention of a new composition of different metals or metallic substances.
40. To William Beales, Louth—An improved cement for the resistance of fire.

Recorded January 7.

46. William C. Scott, Camberwell—Improvements in wheels.

Recorded January 8.

59. Francis Parker, Northampton, and William Dicks, Leicester—Improvements in boots, shoes, and that kind of spatterdashes termed Antigropelos.

Recorded January 11.

69. Joseph Beattie, Lawn-place, South Lambeth—Certain improvements for economising fuel in the generation and treating of steam.
71. Henry C. Jennings, Great Tower-street—Improvements in separating the more fluid parts of fatty and oily matters.
73. Joseph R. W. Atkinson, Leeds—Improvements in machinery for preparing and spinning flax, tow, and other fibrous substances.
75. John Petrie, junior, Rochdale, and Samuel Taylor, same place—Improvements in machinery or apparatus for washing or scouring wool.

Recorded January 12.

77. John M'Dowall, Walkinshaw Foundry, Johnstone—Improvements in cutting or reducing wood and other substances.
79. John Hick, Bolton-le-Moors, Lancaster—Certain improvements in the method of lubricating revolving shafts and their bearings or pedestals.
80. James Fletcher, Facit, near Rochdale—Certain improvements in machinery applicable to spinning, doubling, and winding of cotton, wool, flax, silk, and other fibrous materials.

81. William B. Nation, King's Norton, and Joseph Dyer, Birmingham—An improvement or improvements in the manufacture of soap.
83. George A. Huddart, Brynkir, Carnarvon—Improvements in the manufacture of artificial leather.
85. William Nairne, South Inch Mill, Perth—Improvements in reeling yarns or threads.
86. Edward Hazlewood, Tufnel Park, Holloway—Improvements in fire-arms and projectiles.—(Communication.)
87. John Capper, Manor-house, and Thomas J. Watson, Devonshire-terrace—Improvements in preparing and bleaching jute and other vegetable fibres.
88. Frederick Lawrence and Alfred Lawrence, Pitfield-street, Old-street-road—Improvements in sluices and lock gates.
89. John Bennett, Bradley Mills, Huddersfield, and Henry Charlesworth, same place,—Improvements in doffing and preparing rovings of wool.

Recorded January 13.

90. Moses Cartwright, Longton, Stafford—An improvement or improvements in the preparation or manufacture of gypsum or plaster of Paris.
91. Charles Bullivant, Birmingham, and Charles Hackney, Balsall Heath, near Birmingham—Improvement or improvements in certain kinds of spoons and ladles.
92. William Brown, Glasgow—An improved method of treating coal and bituminous substances, and for improvements in the treatment of their volatile products.
93. John Rumley, South Shields—Certain improvements in pumps.
94. Edward W. Uren, Walkhampton—Invention for the manufacturing of bricks, pipes, tiles, imitation stone, and peat bricks for fuel, by the means of a machine and arrangements of machinery, titled a central, circular, and horizontal motion.
95. George Fyfe, Newcastle-upon-Tyne—Improvements in protecting vessels and exposed surfaces from injury or decay.
96. John W. Wilkins, Hampstead—Improvements in electric telegraphs, and in the instruments used in connection therewith.

Recorded January 14.

97. Joseph Lillie, Manchester—Improvements in machinery to be used in the process of malting, drying, and seasoning grain, including certain vegetable and other substances.
98. Richard Taylor and Hezekiah H. Salt, Birmingham—Improvements in the manufacture of spoons and ladles.
99. Arthur James, Redditch—Improvements in means of enclosing needles.
100. John H. Vries, Fleet-street—Improvements in obtaining motive power.
101. William Steads, Redcross-street—Improvements in blinds, maps, charts, and other articles wound on rollers.
102. Frederick J. Bramwell, Millwall, and Isham Baggs, Liverpool-street—Improvements in steam machinery used for driving piles, hammering, stamping, and crushing.

Recorded January 15.

103. James S. Kincaid, Dublin—Improvements in ascertaining and registering the number of persons entering or quitting omnibuses or other vehicles or vessels, which improvements are applicable, in whole or in part, to buildings or other places.
104. William Bailey, Manchester—Improvements in the construction of certain parts of apparatus connected with railway signals, and in the mode or method of working the same.
105. Edward Tasker, South Hackney—Invention for the purposes of writing and drawing, called the writing and drawing tube.
107. James H. Young, College-street, Camden-town—Improvements in brooms or brushing apparatus.
108. Peter A. Halkett, Richmond-hill—An improved construction of inkstand.
109. John Arrowsmith, Bilston, Stafford—Invention of certain new or improved pumping machinery.

Recorded January 16.

110. Thomas Potts and James S. Cockings, Birmingham—Improvements in the manufacture of tubes, and in the application of tubes to certain purposes.
111 Thomas C. Ryley, Haigh Foundry, near Wigan, and Edward Evans, same place—Certain improvements in the construction of wrought-iron wheels, to be used upon railways or for other purposes, and in the machinery or apparatus connected therewith.
112. Alexander Yorston, Belfast—Improvements in the construction and arrangements of parts of railways.
113. William Nairne, South Inch Mill, Perth—Improvements in power-looms.
114. Auguste E. L. Bellford, Castle-street, Holborn—Improvements in the manufacture of batting or wadding.—(Communication.)
115. Auguste L. Bellford, Castle-street, Holborn—Improvements in the manufacture of blocks for printing music.—(Communication.)
117. Henry H. Henson and William F. Henson, Hampstead—Improvements in signalizing on railways, and in the apparatus used therein.
118. Auguste E. L. Bellford, Castle-street, Holborn—Improved machine for obtaining motive power.—(Communication.)

Recorded January 18.

119. Christopher Binks, Albert Villa, North Woolwich—Improvements in producing electric light.
120. John T. Manifold and Charles S. Lowndes, Liverpool—Improvements in steam-engines.
121. Henry Browning, Bristol—Improvements in preparing compositions for coating iron and other ships' bottoms, and other surfaces.
122. Frederick G. Underhay, Wells-street, Gray's-inn-road—Improvements in machinery for mowing and cutting corn and other crops.
123. Orlando Reeves, Taunton—Improvements in the manufacture of manure.
124. Alfred V. Newton, Chancery-lane—An improved sewing machine.—(Communication.)
125. Peter Fairbairn, Leeds, and Samuel R. Mathers, same place—Certain improvements in machinery for drawing the sliver and rove of flax, hemp, and tow.
126. Thomas Lees, Squire Lees, John Lees, and Thomas Lees, junior, Stockport—Improvements in apparatus for admitting water to boilers.
127. John Sheringham, 24 Edwardes-square, Kensington—Certain improvements in stove grates.
128. Robert Neale, 49 Cumming-street, Pentonville—Improvements in the process of copper and other plate and cylinder printing and inking, and wiping and polishing by machinery the engraved plates and cylinders whilst used in the process.
129. William Vincent, 195 Brick-lane, Spitalfields—Improvements in cocks or taps.

Recorded January 19.

130. Sydney Smirke, 24 Berkeley-square—Improvements in apparatus for giving signals on railways.
131. Joseph R. Cooper, Birmingham—Improvements in fire-arms.
132. William F. Snowden, King's-cross—An improved mangle.
133. William E. Newton, Chancery-lane—Improvements in lamps or lanterns.—(Communication.)
134. Thomas Judge, High-street, Hampstead—Improvements in propelling vessels.
135 Celestin Malo, Dunkerque, France—Improvements in steam generators.
136. Joseph Maudslay, Lambeth—Improvements in steam-engines, which are also applicable wholly or in part to pumps and other motive machines.

Recorded January 20.

137. John Crabtree, Heywood, Lancaster—Improvements in machinery for winding and doubling yarns.
138. Peter R. Jackson, Salford—Improvements in the manufacture of hoops and tyres for railway wheels and other purposes.
139. John W. Ward, Halifax—Improvements in the manufacture of woven or textile fabrics.
140. Cornelius Ward, 36 Great Titchfield-street, Mary-le-bone—A new construction of the musical instrument designated the bassoon.
141. Cornelius Ward, 36 Great Titchfield-street, Mary-le-bone—An invention for combining the musical instruments, designated the drum and the cymbals, in such manner as to make them as one instrument, which instrument he terms the "cymbol drum."
142. Richard M. Deeley, Audman-bank, Stafford—Improvements in the grates of furnaces used in the manufacture of glass.
143. Horace de Manara, Liverpool—Certain improvements and arrangements applicable to steam-boats and other navigable vessels, for the purpose of preventing sea-sickness.
144. William Riddle, East Temple-chambers—Improvements in ornamenting walls, ceilings, and other surfaces.
146. Augustus T. J. Bullock, Lieutenant, R.N.—Improvements in taps and cocks.
147. William Williams, Eccleshall—Improvements in refrigerating apparatus.

Recorded January 21.

148. George Carter, Mottingham-lodge, Eltham—Improvements in the construction of furnaces.
149. Eliezer Edwards, Birmingham—An improvement in the construction of knobs, handles, and other articles of glass, earthenware, and other vitreous and semi-vitreous substances, and in attaching the same to doors, drawers, and other articles.
150. John Addison, 3 Lawn-place, South Lambeth—Invention for keeping up a communication between the guards and engine-driver, and between the guards and passengers, by means of a lamp signal, which answers both for a day and night signal for a railway train.
151. Abraham A. M. Knipsehaar, of the Hague—An illuminated night clock.
152. George Thornton, Grange, Gargrave—Certain improvements in propelling vessels.
153. James Middlemas, Edinburgh—Invention for the application of a new material to the construction of portable houses and other buildings.
155. William Taylor, How-wood, Renfrewshire—Improvements in the production and application of heated air.
156. Matthew Andrew, Hyde—Certain improvements in fastenings for windows.
157. Alexander Prince, Charing-cross—Improvements in the manufacture of articles of furniture, and other articles of a useful and ornamental character, by the use and application of a certain vegetable production belonging to the family of the cactus plant, and in the mode of treating and preparing such vegetable production, so as to render it available for the above purposes.—(Communication.)
158. William J. Curtis, 23 Birchin-lane—An invention for excavating or digging earth, and for carrying or delivering the soil.
159. Reuben Plant, Brierly-hill—Improvements in the construction of glass-house furnaces.
160. John Chubb, St. Paul's Churchyard, and John Goater, lockmaker—Improvements in locks and latches.

Recorded January 22.

161. Louis J. J. Malegue, Paris—A certain colouring composition for dyeing tissues, or stuffs of silk and cotton.
162. Benjamin Quinton, Birmingham—A new or improved fastening for brooches and other articles of jewellery and dress.
163. John P. M. Myers, Tenby—Improvements in the manufacture of artificial fuel.
164. William Sharples, Star Hotel, Bolton—Improvements applicable to apparatus used for marking or scoring at billiards and other games.
165. William D. Steevens, Hart-street, Covent Garden—An improved mode of signalizing or conveying alarum and other signals between one part and another of a train of railway carriages.
166. George Fyfe, Newcastle-upon-Tyne—Improvements in safety lamps, which improvements, or parts thereof, are applicable to other lamps.
167. John Medworth, 9 Claremont-cottages, Kensington, and Lawrence Lee, 498 New Oxford-street—Improvements in lithographic presses.
168. Joseph Paul, 7 Prairie, Lowestoft—Improvements in machinery for making drains in land.
169. Peter H. Desvignes, Lewisham, and Francis X. Kukla, same place—Improvements in galvanic batteries.
170. Arthur W. Callen, Peckham, and Abraham Ripley, Westminster-road—An improvement in the modes of giving and transmitting multiplying rotative motion to shafts and other revolving bodies.

Recorded January 24.

171. Henry Brinsmead, St. Giles-in-the-Wood—An invention for reaping all kinds of corn.
172. Howard A. Holden, Edward Bull, and Alfred Knight, Birmingham—A new or improved method of communicating between the guard and driver of a railway train.
173. Benoit Perreyon, 39 Rue de l'Echiquier, Paris—A new mode of fastening buttons to garments, and an improved button, and also in machinery for manufacturing the same.
174. Davis C. Knab, Rue Rossini, Paris—Improvements in the process of, and apparatus for, distilling certain vegetable and mineral matters, and also animal bones and flesh.
175. Donald Beatson, Mile-end—Improvements in the means of propelling ships and other floating vessels.
176. William Nairne, South Inch Mill, Perth—Improvements in dressing yarns for looms.
177. Charles Randolph and John Elder, Glasgow—Improvements in propelling vessels.
178. William Kendall, Blawith, near Ulverston—Improvements in the manufacture of boxes and similar articles, and in the machinery or apparatus so employed therein.
179. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in aerial navigation, and in the machinery or apparatus connected therewith.—(Communication.)
180. John Stevenson, Dungannon—Improvements in machinery for spinning flax and tow.
181. Andrew E. Brae, Leeds—A method of communicating signals from one part of a railway train to another.

Recorded January 25.

183. Amédée F. Rémond, Birmingham—A method of ornamenting articles of glass, enamel, and earthenware.—(Communication.)

185. William T. Henley, St. John-street-road—Improvements in covering, laying, and uniting wires and ropes for telegraphic purposes, and in the machinery employed therein.
186. Freeman Roe, Strand—Improvements in paving roads and streets.
187. Frederick Simpson, Red Hill—Improvements in combining materials for cleansing or whiting stone.
188. John Sangster, Cheapside—Improvements in umbrellas and parasols.—(Communication.)
189. Alfred V. Newton, Chancery-lane—Improvements in the manufacture of printing surfaces.—(Communication.)
190. Joseph Wiggins, Horner-street, Lambeth—An improved cement for resisting moisture and damp.
191. Robert W. Sievier, Upper Holloway, and Robert W. Waithman, High Bentham, York—Improvements in bleaching animal and vegetable fibrous materials.
192. Henry H. Price, Neath Abbey—Improvements in raising and forcing water and other fluids.
193. John E. Mayall, Regent-street—Improvements in the production of crayon effects by the daguerrotype and photographic processes.

Recorded January 26.

194. Theodore D. Davis, 16 Castle-street, Holborn—An improved valve for steam and gas engines.
195. Isaac Davis, High Holborn—Improvements in optical and mathematical instruments.
197. Nicolas F. Ador, Castle-street, Holborn—Improvements in preparing plastic materials to be used in the manufacture of fired wares, and for other purposes.
198. Thomas F. Cashin and Joseph Stirk, Sheffield—A grinding machine.
199. Charles Nolet, Ghent, Belgium—Improvements in indicating time.
200. John H. Johnson, 47 Lincoln's-inn-fields, and of Glasgow—Improvements in the method of lubricating machinery, and in the mechanism or apparatus employed therein.—(Communication.)
201. James Combe, Belfast—Improvements in machinery for hackling or combing flax and other fibrous substances.
202. William H. Moore, Wenlock-place, City-road—Improvements applicable to the construction of temporary dwellings.

Recorded January 27.

203. Charles H. Alabaster, Bethnal Green—Improvements in ploughs.
204. Alfred B. Sturdee, Woolwich—Invention of a twin-stern ship or vessel with a protected propeller.
205. Edward Brown, Sheffield—Improvements in the blades of table-knives.
206. James Murdoch, 7 Staple Inn—An improvement in stamping or shaping metals.—(Communication.)
207. Edward J. Biven, Alfred-terrace, Queen's-road, Bayswater—Improvements in the means of communicating signals on railways, and for other purposes.
208. William Galloway and John Galloway, Manchester—Improvements in steam engines and boilers.

Recorded January 28.

210. Robert Shaw, Portlaw, Ireland—Invention for starting, stopping, and reversing steam engines.
211. James Learmont, Edinburgh—Improvements in marine pumps and apparatus connected therewith.
212. William Tranter, Birmingham—Certain inprovements in fire-arms.
213. Alfred Lucas, St. George's—An improved inkstand.
214. Louis C. Koeffler, Rochdale—Improvements in bleaching and dyeing.
215. Joseph Scott, Glasgow—Improvements in closing or stoppering bottles, jars, and other receptacles.
216. George E. Donisthorpe and John Crofts, Leeds—Improvements in combing wool, hair, or other fibrous materials.
217. James P. Kingston, 5 Lewisham-road—Improvements in combining metals for the bearings and packings of machinery.
219. John S. Russell, Great George's-street, Westminster—Improvements in constructing ships and vessels propelled by screw or such like propeller.
220. Rowland Speed, Wandsworth—Improvements in communicating between the guard and driver of a railway train, and in the apparatus employed therein.
221. Richard A. Brooman, 166 Fleet-street—Improvements in cables.—(Communication.)

Recorded January 29.

222. Henry Avins and George Tarplee, Birmingham—Invention of a new or improved brick.
223. Harold Potter, Darwen, Lancaster—Improvements in the mode or method of producing a certain colour or colours on woven or textile fabrics and yarns, and in the machinery or apparatus connected therein.
224. John Standish, Bolton—Improvements in machinery or apparatus used in the preparation of cotton, wool, flax, or other fibrous materials, to be spun.
225. William Archer, Hampton-court—Invention of an im roved mode or modes of preventing accidents by improved signals on railways, parts of which improvements are applicable to blast furnaces.
226. Henry Moorhouse, Denton—Improvements in the mode or method of preparing cotton, wool, flax, or other fibrous materials, and in the machinery or apparatus employed therein.
227. Francis Mackrory, 4 Milton-terrace, Vauxhall-bridge-road, Pimlico—Invention to prevent all dust, blacks, and spray entering the windows; also a preventive from noise caused by winds, called the Pulveris Depulsor, or newly-invented window.
229. Francis Wishaw, 9 John-street, Adelphi—An improved lock, or system of locks.
230. John R. Corry and James B. Corry, Queen Camel, Somerset—A new and improved method of dressing lambskin leather, and cleaning the wool therefrom.
231. Richard A. Brooman, 166 Fleet-street—Improvements in diving-bells, and apparatus to be used in connection therewith.—(Communication.)
233. Marcus Spring, 25 Church-row, Hampstead—Improvement in apparatus for separating gold from matter mixed or combined therewith.—(Communication.)
234. William W. Hewitson, Springfield Mount, Leeds—Improvements in suspending or applying mariner's compasses in vessels built of iron, or partly of iron.
235. Henry Batchelor, Glasgow—Improvements in combining metal plates for ship-building and other engineering constructions.
236. James Shand, 245 Blackfriars-road—Improvements in ships' fire-engines.
237. Samuel Rogerson, Manchester—Certain improvements in the manufacture of braid, and in the machinery or apparatus connected therewith.
238. Lewis Jennings, Fludyer-street—An improved construction of lock.
239. William Constable, Brighton—Improvements in transmitting motive power to machinery, and in regulating the action of rotary machines.
240. William E. Newton, Chancery-lane—Improvements in machinery for dressing cloth.—(Communication.)
241. Jean B. Lavanchy, Tannige, Savoy—Improvements in the construction of collapsible framework of wood or iron, which may be employed for forming portable bedsteads, houses, parts of houses or bridges, and other similar structures, which may occasionally be required to be removed from place to place with facility, economy, and despatch.

Recorded January 31.

244. Thomas Knox, Birmingham—A new or improved rotatory heel for boots and shoes.
245. Charles Caulfield, Creagh, Skibbereen—Invention for propelling vessels through the water by means of tubular propellers, consisting of a tube or tubes, containing each a piston moved by steam or any other motive power.
246. Charles Cowper, Chancery-lane—Certain improvements in preserving butter and other substances.—(Communication from Jean F. N. Brеon, Paris.)
247. Samuel Perkes, 1 Walbrook—Improvements in the mode of constructing certain works applicable to aqueducts, viaducts, railways, canals, rivers, docks, harbours, lighthouses, breakwaters, reservoirs, tunnels, sea walls, embankments, submarine foundations, and other useful purposes.
249. Thomas M. Jones, 42 Southampton-buildings, Holborn—Invention for checking or stopping railway trains of carriages, and steadying the carriages when in motion, and preventing jerking and collision of the carriages.
251. Louis G. Perreaux, Paris—Improvements in machinery or apparatus for testing and ascertaining the strength of yarn thread, wire strings, or fabrics.
252. Edwin Pugh, Whitstable—Improvements in the means of ballasting ships or vessels, and in rendering them buoyant under certain circumstances.
253. John Mason, Rochdale—Improvements in looms for weaving.
254. Thomas Lightfoot, Accrington—Improvements in glazes for pottery or other similar materials.
256. David Chalmers, Manchester—Improvements in looms.
257. Israel P. Magoon, Vermont, U. S.—Invention of a new and useful improvement in steam-boiler chimneys.
259. William Pizzie, Albourn—Invention of a railway carriage break.
260. Marc L. A. Tarin, Mount-street, Grosvenor-square—Invention of an improved dustpan.
261. Marc L. A. Tarin, Mount-street, Grosvenor-square—Improvements in reflectors for diffusing light.
262. James Comins, South Moulton, Devon—Invention of a clod-crusher, land-presser, or pulverizer.
263. Samuel Boreham, Henry-street, Pentonville—Improvements in time-keepers.
265. John Pinkerton, High-street, Borough—Invention of a new mode of applying and combining ornamented glass in the manufacture of useful and ornamental articles.
266. George Stretton, Paddington—A certain improvement in soap, hereby denominated "Amylon, or starch soap."
267. Charles Hadley, Lower Hurst-street, Birmingham—Improvements in the construction and formation of granite and stone pavements and surfaces for carriage and railways.

Recorded February 1.

269. Eliezer Edwards, Birmingham—Invention of a new or improved bedstead, which may be used as a vehicle.
270. Thomas C. Clarkson, 216 High-street, Wapping—Improvements in giving elasticity to certain structures and parts thereof.
271. Edwin Whele, Shiffnal, Salop—Improvements in candles, and machinery or apparatus for making thereof.
272. Joshua Murgatroyd, Heaton-Norris, Lancaster—Improvements in the construction of boilers, and apparatus connected therewith.
273. John Cockerill, Kingston-upon-Hull, and Thomas Barnett, same place—Improvements in the construction and use of coffee-roasters.
274. Thomas Williams and James Plimpton, Middlesex, and Robertson Buchanan, London—Invention of a method of actuating ships' pumps by the motion of the vessel at sea, which is also applicable to other purposes.
275. James Carter, Oldham, Lancaster—Invention of an improved rotary engine.
277. William Levesley, Old Ford, Middlesex—Improvements in the construction of pencil-cases.

Recorded February 2.

278. William Gregory, Vernon-place, Bloomsbury—Improvements in the manufacture of bricks and tiles.—(Communication.)
280. Auguste E. L. Bellford, Holborn—Improvements in the manufacture of candles.—(Communication.)
282. Auguste E. L. Bellford, Holborn—Invention of a stoppering apparatus for bottles containing liquids, of which small quantities are generally poured out at a time.—(Communication.)
284. John Smeeton, Limehouse—Improvements in the manufacture of dials applicable to telegraphic instruments, chronometers, barometers, sextants, quadrants, compasses, clocks, watches, and other time-pieces.
286. Owen Williams, Stratford, Essex—Improvements in water-closets.
288. Richard A. Brooman, 166 Fleet-street—Improvements in expansion valves for steam-engines.—(Communication.)

Recorded February 3.

294. George J. Newbery, Woodland-grove, East Greenwich—Improvements in hinges.—(Communication.)
296. Benoit Dulaurier, Paris—Invention of a new application of a system to render boots and shoes waterproof without sewing or nailing whatever, and the said invention to be applied also to render waterproof hats, caps, and general hatting; the invention consists also in the application of machines to the manufacturing of general shoemaking and hatting.
298. James Greenhalgh, Cheetham, Lancaster—Certain improvements in churns.
300. William Richards, Stourbridge, and Edwin Beck, Cookley—Certain improvements in machinery for exhausting and driving atmospheric air.

☞ *Information as to any of these applications, and their progress, may be had on application to the Editor of this Journal.*

DESIGNS FOR ARTICLES OF UTILITY.

Registered from 27th January, to 1st February, 1853.

Jan. 27th,	3414	J. C. Onions, Birmingham,—"Extra blast telegraphic wire-welding forge."
28th,	3415	P. H. De la Motte, Westbourne-grove,—"Portable camera."
—	3416	W. Leggat, Derrythorpe,—"Ploughshare."
Feb. 1st,	3417	W. Eassie, Gloucester,—"Pole and bolster for railway trucks."
—	3418	Witton, Daw, and Co., City,—"Rifle and pistol-sight."

DESIGN FOR ARTICLE OF UTILITY.

Provisionally Registered 1st February, 1853.

Feb. 1st,	491	S. C. Kingston, Kensington,—"Hat mirror."

TO READERS AND CORRESPONDENTS.

Completion of the 5th Volume of the Practical Mechanic's Journal.—With the present Part (No. 60), Vols I. II. III. IV. and V. are completed, and may be had from any bookseller, in cloth, lettered, price 14s. each, or the whole 60 Parts separately, for binding to suit the purchaser. Vols. I. and II. and III. and IV. may also be had, handsomely bound in half calf, and lettered, to form two double volumes, with the plates bound separately to correspond, either in one or two volumes, price £1. 10s. 6d. for each double volume and volume of plates. Volume V. contains 304 pages of letterpress, 25 copperplate engravings (equal to 34 pages, many of the plates being of large size), and nearly 500 wood engravings. The entire five volumes contain 1500 pages of letterpress, 120 copperplate engravings, and 1700 wood engravings.